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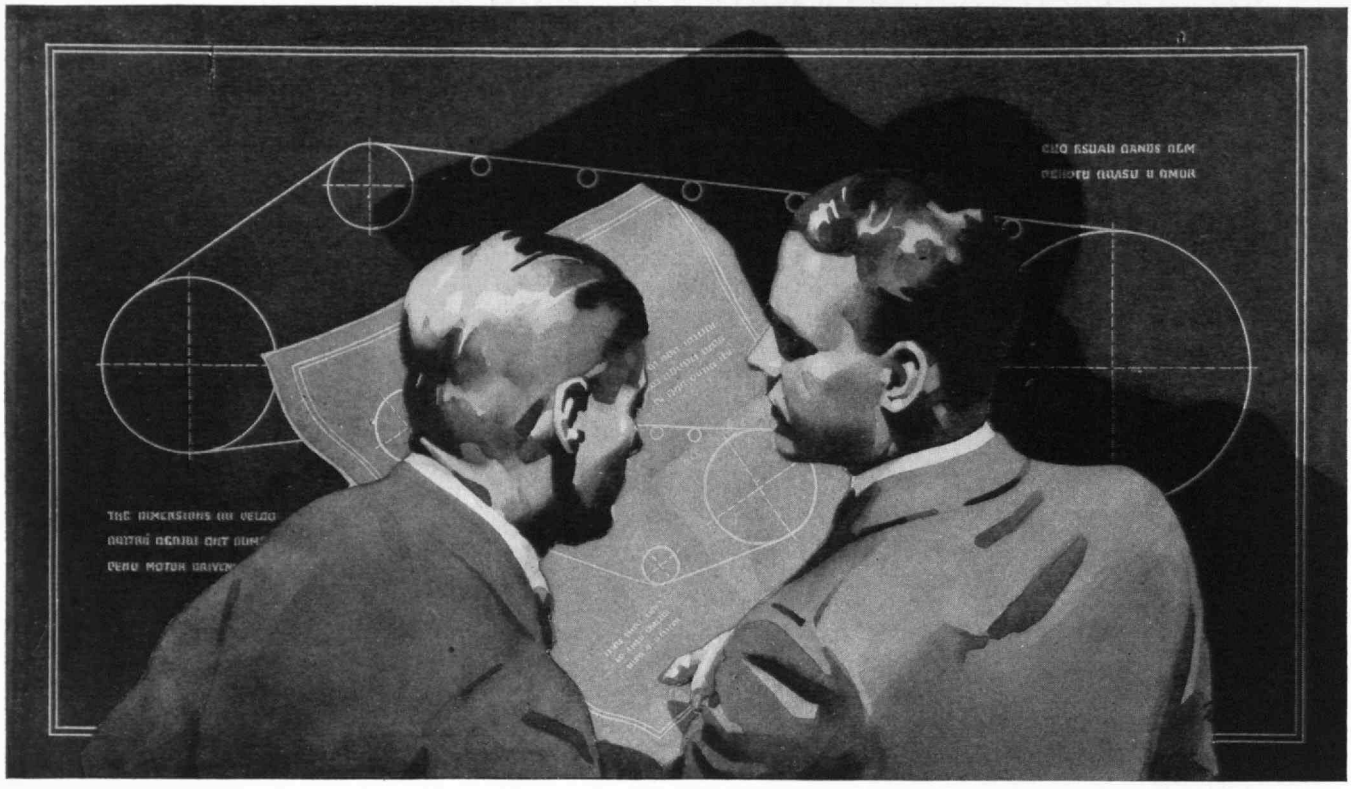
THE TABULAR VIEW

AT the end of every year it has become customary for publications to survey the achievements of that year. Feeling that looking into the future is equally as important as recalling the dear, dead past, The Review in this issue has worked a variation of the yearly survey vogue by presenting a forecast of what may be the outstanding developments of 1933. In short, it anticipates by 11 months many of the achievements that doubtless will be listed next January by publications which catalogue engineering achievements. The method by which the curve of engineering progress has thus been extrapolated has been explained on Page 170, but it is meet to add here that The Review Editors are grateful to the many engineers, educators, and journalists who not only suggested trends and projects to be included in this pre-view but recommended the exclusion of many others.

DESPITE his burdens as President of M. I. T., Dr. KARL T. COMPTON is still actively engaged in scientific research. He speaks, therefore, not only as the administrator of a great scientific institution, but as one who knows intimately the trials and triumphs of the laboratory. The dual nature of his work peculiarly fits him to describe the technique and objects of modern physical research in terms understandable to the layman, and his article on Page 165 is a scientist's history, addressed to laymen, of man's efforts to transmute the elements. At the risk of violating the rule of etiquette prohibiting "pointing," The Review Editors call the attention of all readers to this article as an example of lucid scientific exposition. Those who would be informed of the trends and aims of modern physics in general and of the particular efforts which have been directed towards disintegrating the atom, should not fail to read "The Battle of the Alchemists." ¶ Professor ERWIN H. SCHELL, '12, is Head of M. I. T.'s Department of Business and Engineering Administration. This Department has been conducting some very revealing studies of the occupations, salaries, and progress of its graduates. Readers of The Review will recall the article in the March, 1930, issue entitled "What Engineers Become." Professor Schell has taught not only at M. I. T. but in the Harvard School of Business. He has also practised as a consulting engineer on problems of industrial management.

HAROLD G. CROWLEY, '23, is an experienced pilot and aviator. He was in charge of air operations for the two Forbes-Grenfell Expeditions for the mapping of the Labrador Coast. ¶ Dr. TENNEY L. DAVIS, '13 is a Contributing Editor to The Review and an Associate Professor of Organic Chemistry at Technology. Aside from his contributions to various technical journals on chemical research, he has written much on the history of science, and he participates in the editing of several journals devoted to science history. He contributes every month to *The Trend of Affairs*.

A Man and a Plan



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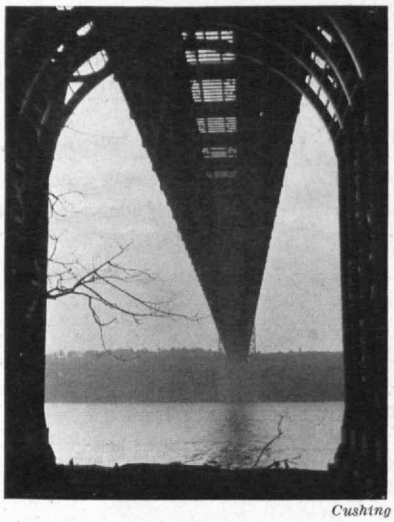

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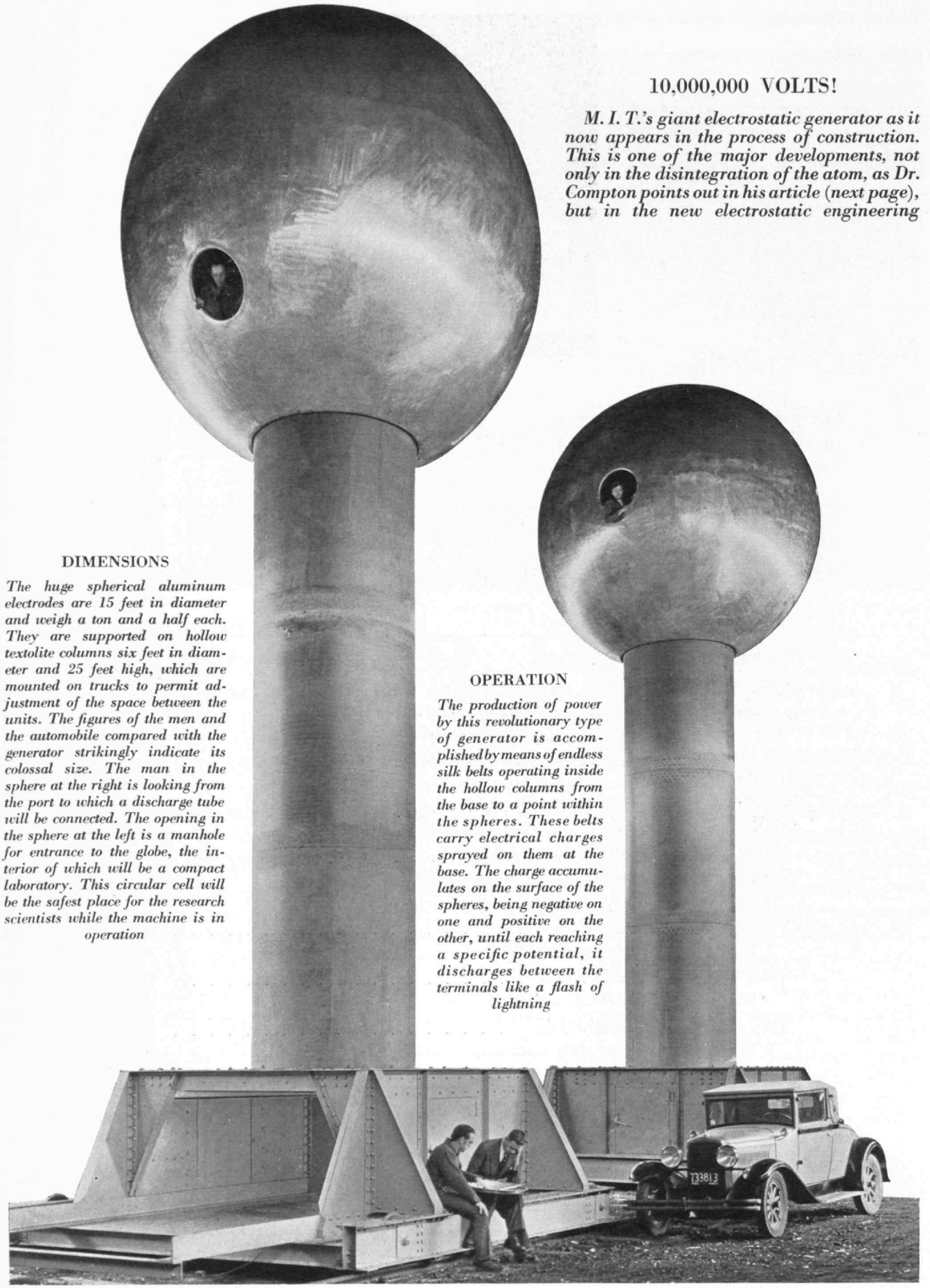
10,000,000 VOLTS!

M. I. T.'s giant electrostatic generator as it now appears in the process of construction. This is one of the major developments, not only in the disintegration of the atom, as Dr. Compton points out in his article (next page), but in the new electrostatic engineering



DIMENSIONS

The huge spherical aluminum electrodes are 15 feet in diameter and weigh a ton and a half each. They are supported on hollow textolite columns six feet in diameter and 25 feet high, which are mounted on trucks to permit adjustment of the space between the units. The figures of the men and the automobile compared with the generator strikingly indicate its colossal size. The man in the sphere at the right is looking from the port to which a discharge tube will be connected. The opening in the sphere at the left is a manhole for entrance to the globe, the interior of which will be a compact laboratory. This circular cell will be the safest place for the research scientists while the machine is in operation

OPERATION

The production of power by this revolutionary type of generator is accomplished by means of endless silk belts operating inside the hollow columns from the base to a point within the spheres. These belts carry electrical charges sprayed on them at the base. The charge accumulates on the surface of the spheres, being negative on one and positive on the other, until each reaching a specific potential, it discharges between the terminals like a flash of lightning

THE
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REVIEW

Vol. 35, No. 5

February, 1933

The Battle of the Alchemists

Attacks, Ancient and Modern, on the Citadel of the Atom

By Karl T. Compton

How Modern Experimental Physicists Are Marshalling All the Resources of Science to Storm the Seat of the Atom, and Thus to Dispel Man's Gross Ignorance of the Most Powerful Elements of His Material World

LONG, long ago, when gods mingled among men, the god Hermes established the first laboratory on this earth and discovered many new and interesting substances by subjecting various kinds and mixtures of earth and rocks to the influence of fire or water. Not being blessed with the protection of the U. S. Patent Office, he kept his discoveries secret by putting his products into jars which were carefully closed and sealed. Hence arose the term "hermetically sealed," and the chemistry and metallurgy which thus sprang from the god Hermes was long known as the "hermetic art."

According to another legend, a group of wicked angels were expelled from heaven and settled on the earth, taking unto themselves human wives. To these wives the fallen angels disclosed the magic secrets of science, and the wives recorded these secrets in a book which was called "Chema" — the first handbook of chemistry. Thereafter those who practised this art were called "alchemists." The ancient historian Tertullian tells of these fallen angels who thus revealed to mankind the knowledge of gold and silver, precious stones, and medicines.

However these things may be, there is ample documentary evidence from Egypt that alchemy was a flourishing science and art in Alexandria before the third century A.D. and it is probable that a famous book whose destruction was ordered by Diocletian in about 290 A.D. was one containing receipts and formulas for producing alloys to simulate gold and silver and for manufacturing artificial jewels.

These early alchemists, like modern chemists, were guided by a theory. Like our modern theories, theirs was imperfect and like ours it was an attempt to interpret and predict on the basis of a generalization of experience. They started with Aristotle's conception of four fundamental elements — earth, water, air, fire. (These are not so different from, for example, the notion of the four states of matter proposed by Sir William Crookes: the solid state, the liquid state, the gaseous state and the ionized state.) The alchemists also believed that there was one basic entity — *prima materia*, which was identical in all bodies but which took different forms according as it was brought into combination with one or more of the fundamental elements, earth, water, air, and fire. (In our time, we recognize this *prima materia* to be electricity existing in two forms as electrons and protons.) By action of earth, water, air, or fire on the various manifestations of the *prima materia*, these alchemists performed oxidation, reduction, solution, smelting, alloying — and it is not to be wondered that they interpreted their work as a "transmutation of matter." From their standpoint it was transmutation.

On account of the variety of colors which their compounds exhibit, and their ease of chemical change, it is not surprising that mercury and sulfur were of particular interest to the alchemists, and were supposed to be quite close to this *prima materia* which they sought. It is not so easy, however, to understand their choice of some of the other substances. For example, Beauvais, in 1250, classified matter as consisting of four spirits and six bodies: the four spirits were mercury, sulfur, arsenic and sal ammoniac; and the six bodies were gold, silver, copper, tin, lead and iron — of which gold and silver were pure and the rest impure.

We must not despise the efforts of these alchemists. Among them were numbered such great minds as Newton, Leibnitz and Boyle, all of whom studied and practised alchemy, though they were beginning to realize its defects. But from this mixed ancestry of legend, experiment and magic was born the modern science of chemistry!

IN THE rapid rise of chemistry during the 19th Century, a beautiful and nearly perfect scientific theory of atoms and molecules was developed as a far extension of the ancient philosophical ideas of atoms of Democritus. The soundness of this theory was demonstrated by the fact that it was only extended, but not essentially changed, when physicists devised methods of counting and weighing molecules individually, and of measuring their separate velocities and the energy and force required individually to pull them apart into their constituent atoms. The puzzles of the old alchemists were solved by the recognition of two classes of substances, elements and compounds, of which the former retain their identity throughout all action of earth, water, air, fire — or any other physical or chemical agent. Thus alchemy, which sought to transmute the elements, became supplanted by chemistry, which occupied itself with the various combinations of these elements to form chemical compounds. "Alchemy was dead! Long live chemistry!" But is this the end of the story?

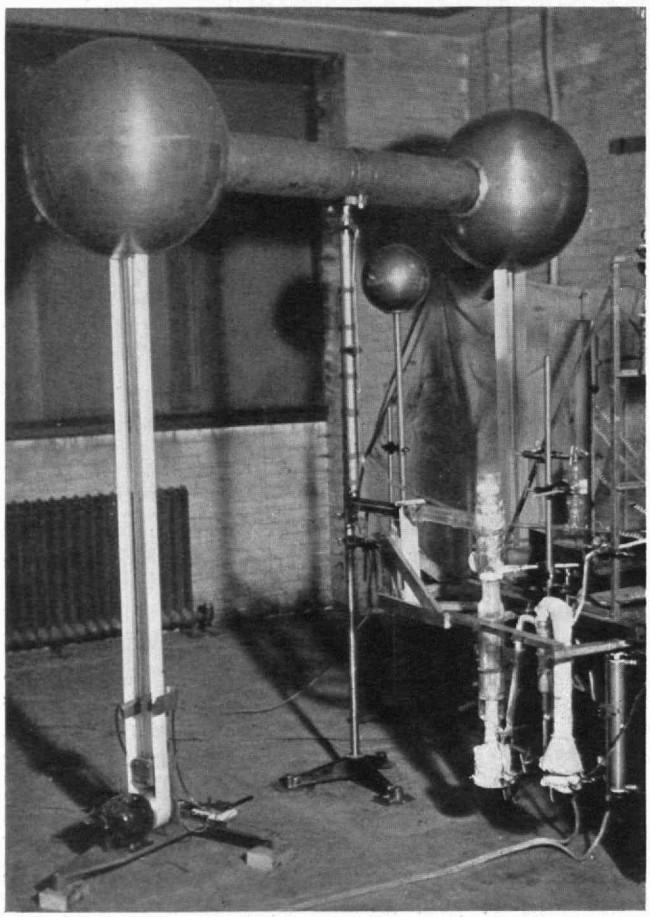
The text book in which I first studied chemistry in 1904 defined an atom as "an indivisible, indestructible and unchangeable unit of matter." Yet five years earlier J. J. Thomson and his colleagues had split up atoms into electrons and positive ions and within twenty years it had come to be realized that the atom could be very changeable, could in fact exist in any one of an infinitely infinite variety of conditions commonly termed "excited states." Thus the atom is *not* indivisible and is *not* unchangeable. But these changes do not really affect the identity of the atom; the electrons which it loses come back to it or others take their places; it does not stay in its excited states very long but reverts to its normal state usually within a hundred millionth of a second. So, after all, the atom is still the same old atom, and its new attributes which have been discovered by the physicists, while they add to its versatility, do not undermine its fundamental character of good old-fashioned chemical respectability.

In its ionization and its excited states the identity of the atom is like that of a man. You may cut off his hair or his nails; they come back. You may even amputate a finger or a leg, but he is still the same man. Or you may excite him to a fit of anger or activity, but he cools down again. Through it all he retains his identity through that mysterious something that we call his soul.

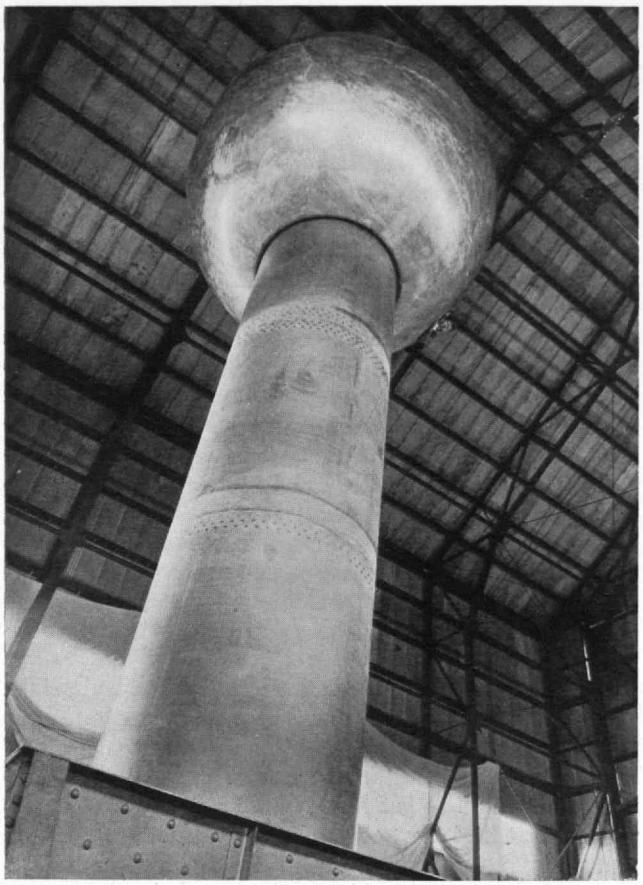
Now the soul of an atom is its nucleus. Through ionization and excited states this nucleus remains, so far as we know, unchanged. Until we know the nucleus of the atom we no more know the atom than do we know a man by his hair, nails, fingers or legs. What do we know about the nucleus?

Beyond a doubt we know very exactly the mass of every kind of atomic nucleus and that it is composed of a definite number of protons and electrons, which we know, and that it has a positive electric charge, which we know accurately. Thus the hydrogen nucleus consists of a single proton; the helium nucleus consists of four protons and two electrons and has a mass which is 0.77% less than the sum of four hydrogen nuclei; the uranium nucleus consists of 238 protons and 146 electrons, etc. We also know that the nucleus is very small in comparison with the over-all atomic dimensions, i.e., much smaller than 10^{-10} cm. in diameter — probably less than 10^{-11} cm.

We have good reason for thinking that some atomic nuclei are magnets, with a magnetic moment equal to that of one electron, and that this is true if there is an



Van de Graaff's first model 1,500,000-volt generator, with a discharge tube of new design connected between the terminals. The spheres in this model were two feet in diameter as compared with the 15-foot diameter spheres in the new generator at Round Hill. The characteristics of the tube shown in this picture are described in the current issue of the Physical Review



Looking up one of the two giant spherical terminals of M. I. T.'s new electrostatic generator. (*See pages 164 and 189.*)

odd number of electrons in the nucleus. But there are some phenomena which have not as yet been reconciled with this idea of the magnetic properties of the nucleus. Furthermore there is reason to believe that the proton configurations in the nucleus may also contribute a magnetic moment, far smaller than that due to the electrons.

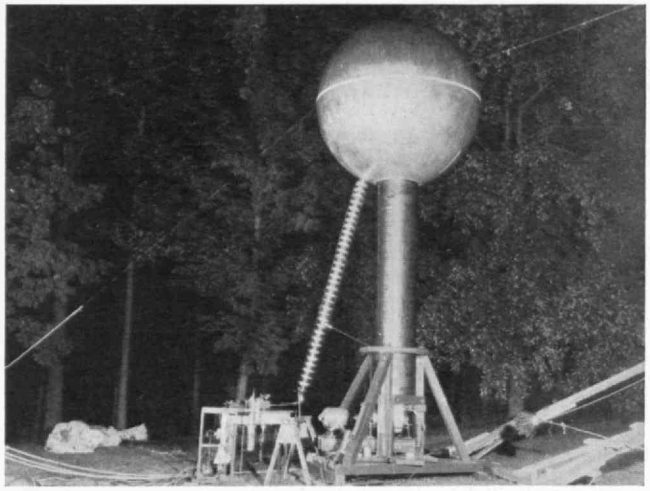
We know that atomic nuclei are deformable under the action of intense forces, such as can only be exerted by electrified particles, like alpha particles from radium, which are shot toward the nuclei with such tremendous velocities that they may come very close before being deflected away by the repulsive force between nucleus and alpha particle. When their distances are greater than 10^{-10} cm., this force varies inversely as the square of the distance as nearly as we can tell, which shows us that the nuclei are practically electrified points so far as distances greater than 10^{-10} cm. are concerned. With closer approach, however, the force departs more and more from the inverse square law, showing that the nuclei have a structure or arrangement of electricity within their tiny domain, and that this structure may be deformed by strong electrical forces. All this information is inferred from studies of the angular distribution of scattering when alpha particles pass through thin films.

We know that the nuclei are the seats of tremendous energies, as evidenced directly by phenomena of radioactivity and indirectly by certain aspects of the theory of relativity to which I will refer later. From radioactivity, also, we find that groups of four protons and two electrons (helium nuclei) appear to be particularly stable configurations within the larger structure of the nuclei of heavy atoms. We call these groups "alpha particles."

Having said these things, we have told almost everything that is known about atomic nuclei. Many other things we would tremendously like to know. How are the protons and electrons arranged in the nucleus? What is their state of motion? What forces hold them together? How is their energy stored away? Under what conditions can the nucleus be disrupted or this energy released, or the configuration changed? To all of these questions we must confess almost total ignorance.

Think for a moment what this ignorance implies. All of the positive electricity, most of the negative electricity, most of the mass and by far the greater part of the energy of the world reside in atomic nuclei. We must therefore confess that we know as yet very little about most of the world of matter, electricity and energy. This should make us rather careful about making such statements as one recently published by a leading exponent of the new school of theoretical physicists who wrote, "The underlying physical laws necessary for the mathematical theory of a large part of physics and the whole of chemistry are thus completely known. . . ." It should also warn us against such rash terms and statements as "the breakdown of the law of causality" and "the law of conservation of energy does not apply to individual processes, but only statistically as an average." It would be far better simply to admit that, successful as we have been in describing by equations much of the behavior of those extra-nuclear electrons, we are still grossly ignorant of the most powerful elements of our material world.

A very crude analogy will illustrate the relative advancement of our present state of knowledge of atoms. Liken the nucleus to a building and the extra-nuclear electrons to a group of pebbles resting on the steps of a fire escape on the outside of the building. As we observe these pebbles, we notice that, from time to time, a pebble falls from one step to another. We do not understand why it falls, and make various attempts to hypothecate some model or mechanism which will explain the dropping of these pebbles. Bohr, Sommerfeld, and Langmuir all take their turn, but none of them invents a mechanism which satisfies all of the observations. We become discouraged with model building. Finally a brilliant young man, Heisenberg, proposes that we do away with models entirely and concentrate entirely upon the observable quantities — the steps, the pebbles and their falling. He finds a mathematical expression which accurately correlates the height of the steps (energy levels) with the probability that a pebble will fall (radiate) from one step to another. To the mathematician this accurate formulation of the mathematical relationship between the observable quantities is a complete and satisfactory explanation or theory. The physicist, however, guided perhaps by instinct (which is the accumulated wisdom of the ages) rather than by formal logic, is not satisfied. He feels impressed but a bit confused by the logic of the mathematician, and also a bit distrustful. Down in his heart he feels that there must be something more than a law of probability which makes those pebbles drop. He goes to in-



A model of the Van de Graaff generator built by Dr. Merle Tuve at the Department of Terrestrial Magnetism of the Carnegie Institution in Washington. It has a six-foot sphere and is shown with an x-ray tube connected between the terminal and the earth. Its outdoor operation has been interrupted by the bugs and fireflies drawn to the sphere

vestigate. He finds the door of the building locked. He pushes; he knocks; he gets help; he rigs up a machine to batter down the door; he makes a small hole through which he sees signs of activity within the building; he builds a bigger and better battering ram; he finally breaks down the door and goes in. Within the building he finds a huge factory; giant cranes carry around great masses of material; enormous machines press, hammer and draw this material into various shapes. Stupendous forces are at work. The building shakes, and from time to time a little pebble on the fire escape is shaken down from one step to another.

So, I suspect, may sometime be resolved the peculiarities and puzzles of our present quantum theory — by small external manifestations of the enormous energy which we know to exist within the nucleus, but about which we now know too little even to make a guess as to how it may influence our present theories.

BE this as it may, where have we left the alchemist? We left him dead, killed by the chemist who had destroyed his hopes of effecting the transmutation of elements. But now the physicist has brought him to life again, with renewed vigor and enthusiasm. For if the atomic nucleus is a structure of electrons and protons, it should be possible to break up this structure or to add to it, and thus to change one chemical element into another. The agencies are no longer earth, water, air, and fire, but electricity and probably electrical particles shot with tremendous speeds into nuclei. The goal is not gold and silver, but energy. And with the alchemist, who is a practical man trying to get something, is working the physicist, who is not an impractical man, trying to learn something. In fact they are one and the same man.

A most significant event in this story was the discovery of radioactivity by Becquerel thirty-six years ago. Its significance became evident when Rutherford showed that the alpha and beta particles are, respectively, helium nuclei and electrons which are shot out of the nuclei of radioactive atoms with tremendous speeds, approaching that of light. Its significance became greater when Rutherford further showed that the parent atoms, in thus ejecting these particles, transform into atoms of different chemical elements. The law of this transmutation was stated by Fajans: expulsion of a beta particle changes the atom into the next higher one in the Periodic Table, and the expulsion of an alpha particle changes the atom into one which is two steps lower in the Table. Here, for the first time, were authenticated cases of transmutation of elements.

The energies liberated in radioactive transformation are prodigious, in comparison with the amount of material involved. For example, radium continually gives off enough energy to raise its own weight of water from freezing to boiling temperature every hour. By the end of 2000 years it will be only half used up. By the time it is completely transmuted into its final products, helium and lead, any given amount of radium will have generated an amount of heat equal to that from the combustion of 500,000 times its weight of coal. One pound of radium gives off enough energy to heat to boiling more than 13,000 tons of melted ice.

At first sight it appeared that here was at last in sight the goal of the alchemists. But, alas, there was one difficulty, the process is so slow. Suppose you have a gram of radium (which is a notable amount). You would have to wait 2000 years to get half of its energy, another 2000 years to get half of what is left, and so on. By that time you and your grandchildren will long have ceased to worry about a source of heat. Great as it is, the energy comes off so slowly that it leaks away and cannot be stored up for use when wanted. As a practical source of energy it is useless. Alchemists and others have tried every physical and chemical agency that they could devise in an effort artificially to speed up radioactive processes, but without avail. The process of radioactive transmutation proceeds in its own characteristic slow and sure manner most provokingly unaffected by man's best, but puny efforts.

There are, however, some very decided rays of hope, for artificial transmutation has been produced in three distinct ways, on a small scale. One of these dates back to about the time of the war, while the others have both been achieved within the past couple of years.

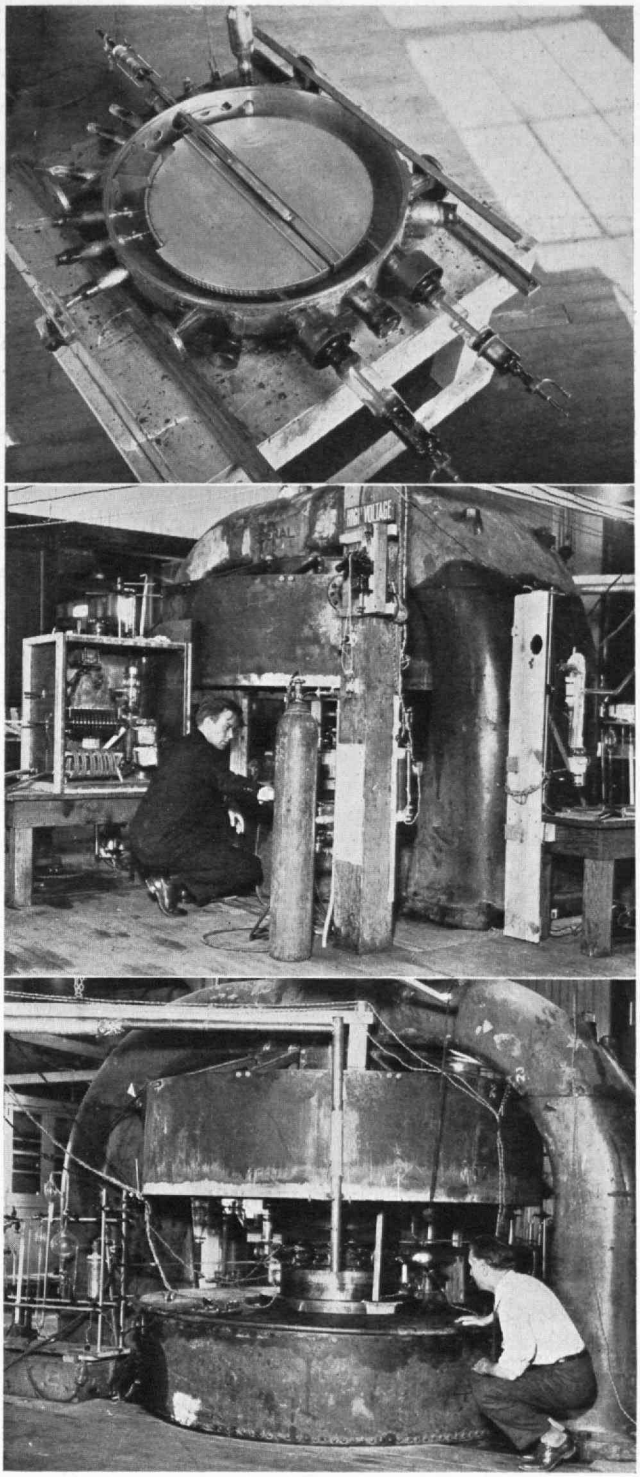
During the war I was charged with arranging for the demonstration of a French device for locating submarines, for the benefit of British and American scientists who were engaged in the same problem. One of the British experts was Sir Ernest Rutherford. He sent word by the late Professor Bumstead, however, that he would be delayed through the necessity of completing certain laboratory experiments in which he thought that he had split hydrogen nuclei into two parts. "If this is true," he said, "its ultimate importance is far greater than that of the war." With true scientific caution, however, he asked us to keep this matter confidential, since he was not yet sure of his interpretation. This caution was justified, for his subsequent work showed that he had not broken up hydrogen nuclei; but what he did find was equally significant: he had succeeded in knocking protons out of the nuclei of nitrogen, aluminum and various

other light atoms. This was the first success attained in man's long struggle by his own efforts to change one chemical element into another.

Rutherford's success came not by luck and persistence, but by trained physical insight and persistence. Realizing that the possibility of success lay in bringing the largest possible electrical forces to act on the nucleus, he first found that radioactive substance which shot out alpha particles with the highest speed, and then he let them shoot at the nuclei of light atoms like nitrogen and aluminum. He chose these because of the relatively small electric charges of their nuclei, which repelled the oncoming alpha particles less strongly and therefore permitted them to come closer than the nuclei of heavy atoms would have done.

Under this vigorous electrical bombardment, some of the nuclei gave out protons. These were detected by the sparks of light which they produced on striking glass plates coated with special fluorescent materials. Their speed and their identification as protons were determined by measuring how far they would shoot through air and how much their paths were curved in a magnetic field. These protons may have been literally knocked out of the nuclei by the impinging alpha particles, but from some nuclei, as for example aluminum, the protons were shot out with much greater speeds than they could possibly have acquired from such impacts. It therefore appears that the bombarding alpha particle distorts the structure of the nucleus, which settles down into a new state of stability, shooting out the proton in the process. The alpha particle therefore serves as a sort of key to unlock the nucleus and release some of its energy. Ah! Here we would seem to have achieved our goal. But no, the process is hopelessly inefficient as a practical source of energy. Only about one alpha particle in 600,000 happens to strike a nucleus in such a way as to produce a transmutation. The other 599,999 are simply scattered without apparently exerting any permanent effect on the nuclei with which they come in contact.

THE second authentic type of transmutation is associated with the discovery of the neutron by Chadwick of Cambridge less than a year ago. For many years physicists have been led by logic to search for this neutron, and they have predicted some of its properties. For example we have atoms of atomic numbers from 92 down to 6, 5, 4, 3, 2, 1 — uranium to carbon, boron, beryllium, lithium, helium, hydrogen — whose nuclei have positive electric charges of 92 down to 6, 5, 4, 3, 2 and 1 units, respectively. Why should there not exist an atom of atomic number zero, with no charge on its nucleus? Such an atom would have no extra-nuclear electrons, and its nucleus would consist of equal numbers of protons and electrons (probably one of each) packed very closely together. This atom would have no chemical properties and no physical properties of the usual type, which depend principally upon the electric field of the extra-nuclear electrons. It would obviously be hard to detect, would penetrate easily through even the densest materials, might readily penetrate through even the nuclei of other atoms. The one thing it could do would be to "bump," for if it (*Continued on page 186*)



The high-voltage generating equipment designed at the University of California. The picture at the top of the column shows the interior of the tube Professor E. O. Lawrence uses for the acceleration of light ions to high speeds. This tube is now generating 4,800,000-volt H_2+ ions and is capable of yielding 6,500,000-volt H_2+. At the moment it is being used for the disintegration of lithium by protons in the range 1,000,000 to 2,400,000 volts. The center picture shows Professor Lawrence at the side of the large magnet outfit. The lower picture shows the front side of the big magnet outfit. As will be noted, the tube makes use of about one-half the full diameter of the magnet core. Hence, if the full capabilities of the magnet were used, 25,000,000-volt H_2+ ions or protons could be produced. Commander T. Lucci, who is assisting Drs. Livingston and Lawrence, is shown at the right. (*See further description of the operation of high-voltage apparatus on page 189.*)

Engineering in

Fifty Engineers Coöperate in Forecasting Some of the

THOSE who seek evidence of what Pasteur called "the grandeur and destiny of science in modern society" need but survey the engineering achievements of 1932 or scan the engineering horizon of 1933. Despite the depression, despite all the crippling disorders which inflict peoples everywhere, the "art of directing the great sources of power in nature for the use and convenience of man" has continued steadily productive of great accomplishments.

The achievements of 1932 are on record — an impressive record it is — and need not be reviewed, but there is much to be gained from studying the steadily rising curve of engineering progress and extrapolating it into the future, particularly into the coming months of this year. This The Review has done, using the method described in the adjacent box.

Answers to the question *What will be the most notable engineering projects of 1933?* fall into two groups: (1) lists of research projects and broad engineering trends; and (2) suggestions of definite constructional projects.

While The Review's poll of engineers was primarily concerned with the latter, as the extended list of specific projects below would indicate, there nevertheless were many suggestions, which should be recorded, of developments which cannot be given a definite place or described as a single project.

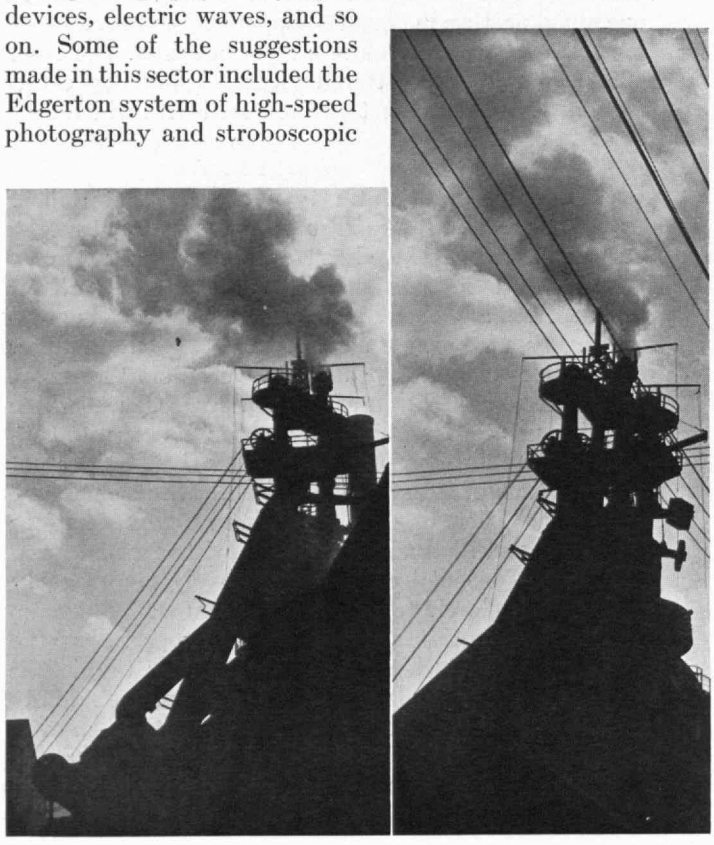
Engineering Trends in 1933

Almost every engineer polled by The Review included factory-built houses in his list of impending developments. There is no denying the wide-spread anticipation of achievements leading to the industrialization of housing; too many fine minds are converging on the problem for it to remain long in its present indeterminate state, and steel was the most oft-suggested material for the new houses. "The Evolving House," a thorough study of the housing problem to be published by M. I. T., is now on the press and will help in clarifying and abetting this great social movement.

It is significant, too, that, next to housing, practical and economical domestic air conditioning was suggested most frequently. Further use of welding was repeatedly listed; its application to structural engineering suggests its value in large-scale production of houses, and its triumphs in shipbuilding, bridge construction, and other fields provide an earnest of its future possibilities, particularly in the saving of weight and space.

All the great integrated engineering enterprises grow and improve by slow accretions, the steady pushing back of frontiers through research. Take the power industry for example. Down in New Jersey, experiments are under way to determine the feasibility of generating electric power by rotor propulsion; at M. I. T. research is finding preventatives for cavitation, the destructive potting of turbine blades; and down at Round Hill, the great 10,000,000-volt Van de Graaff generator nears completion with its promise of not only aiding the physicist in his work of disintegrating the atom, but of founding a new field of engineering based on electrostatics — these research projects and a thousand others pointing to new economies in power generation and a greater knowledge of fundamentals. In Europe there is much study of tying in all power sources into one huge transmission system.

The engineers consulted were alert to the implications of modern physics and to the growing importance of physical engineering — the new technology based on microphotography, x-rays, photoelectric cells, electronic devices, electric waves, and so on. Some of the suggestions made in this sector included the Edgerton system of high-speed photography and stroboscopic



WHAT WILL BE THE MOST NOTABLE ENGINEERING PROJECTS OF 1933? THE REVIEW HAS PUT THIS QUESTION TO 50 INFORMED PEOPLE, INCLUDING PROMINENT PRACTICING ENGINEERS IN ALL PARTS OF THE UNITED STATES, ENGINEERING JOURNALISTS, AND MEMBERS OF THE ENGINEERING FACULTY AT M. I. T. AND OTHER INSTITUTIONS. AT THE SAME TIME THAT THE QUESTION WAS ASKED, AN INITIAL COLLOCATION OF 46 PROJECTS SELECTED BY THE REVIEW STAFF WAS SUBMITTED TO EACH OF THESE AUTHORITIES AND THEY HAD THE OPPORTUNITY TO MAKE DELETIONS AS WELL AS TO SUGGEST ADDITIONS.

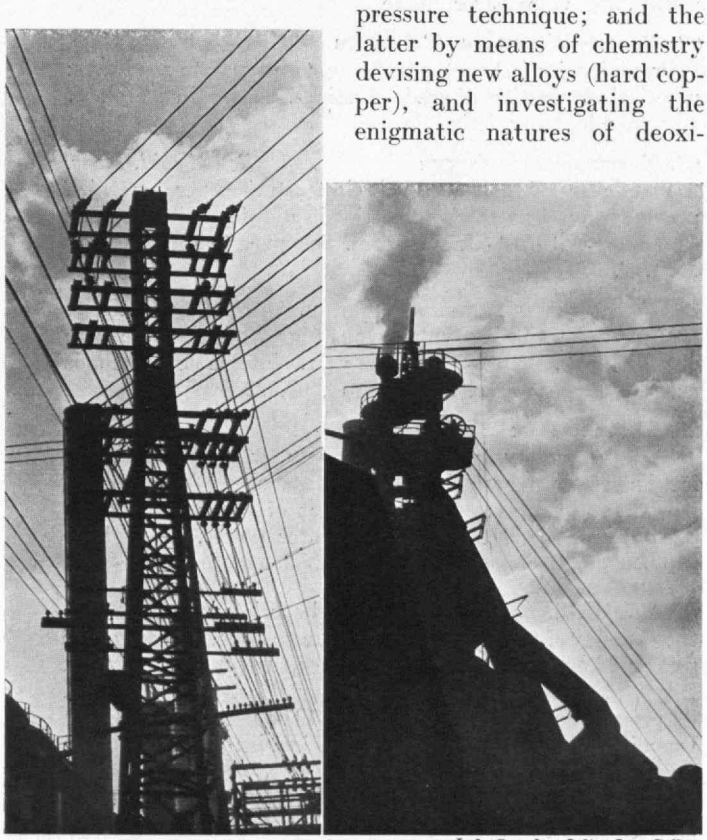
1933—A Pre-View

Notable Engineering Trends and Achievements of 1933

THE NET RESULT OF THIS POLLING OF OPINION IS PRESENTED IN THE ACCOMPANYING ARTICLE, THE FOREIGN WORKS BEING GROUPED SEPARATELY FROM THOSE IN THE UNITED STATES. THE REVIEW DOES NOT PRESENT THESE RESULTS AS AN INCLUSIVE OR EXCLUSIVE PROSPECTUS, NOR DOES IT SUGGEST THAT THE ITEMS TABULATED WILL BE THE MOST IMPORTANT ENGINEERING ACHIEVEMENTS OF THE CURRENT YEAR. THE LIST IS PUBLISHED AS THE MAJORITY OPINION OF A GROUP OF EXPERTS ON WHAT ENGINEERING UNDERTAKINGS, TALKED OF, BEGINNING, IN PROCESS, OR CONCLUDING, MAY EVOKE GREAT PUBLIC INTEREST IN 1933.

observation, new applications of power tubes, the artificial production of beta and gamma rays, seminal discoveries in the phenomena of electrical discharge through gases (more efficient electric lights are being sought), and fundamental contributions from spectroscopy. Electronic substitutes for the human senses will be refined and multiplied.

Chemistry and metallurgy will continue to be enormously productive, the former taking the factory more and more to the farm for its raw products, providing new compounds and better or cheaper old ones (hydrogenated fuels, alcohols, for instance) through high-pressure technique; and the latter by means of chemistry devising new alloys (hard copper), and investigating the enigmatic natures of deoxidizers in steel making. Physical chemistry may even make contributions to power generation through its study of the selenide cell.



Luke Swank—Julien Levy Gallery

The great American renaissance in hydraulic engineering was observed by several of the queried group. Out of the National Hydraulic Laboratory, the river hydraulic laboratories at Vicksburg, M. I. T., and other places, and from the growing interest in hydrodynamics will surely come permanent contributions to pure and applied hydraulics. It is tragic that John R. Freeman's ('76) untimely death last fall removed the man who did so much to bring about this awakening.

Advances in our communication systems were forecast. The expansion of telephone service from continental to inter-continental coverage will go forward with the ultimate goal of embracing all continents and making it possible to connect almost any two telephones in the world. The year will witness advances in the arduous battle to make television more practical. Radio beacon research will improve this important aid to navigation.

Advances in transportation engineering were seen by many. The use of the airplane for prospecting and for opening up inaccessible country is rapidly increasing; the sea-train plan for transporting whole freight trains by water is proving its feasibility; and our large terminal cities are finding it necessary to facilitate the classification and distribution of freight in the manner that has been worked out by the Port Authority in New York City; air transportation will offer faster and safer service; the new seaplanes being built by Italy may up the speed records; the building of super-highways will be pushed. Such great developments as the Boston-Worcester turnpike, the New Jersey high-level viaduct, and many others will emphasize the further need for this type of fast motor travel; the development of high-speed rail cars, some with rubber wheels and others powered by internal combustion engines, will be important; the automatic control of airplanes will be pushed further toward practical use; and there will be further moves toward the streamlining of automobiles. Transatlantic air service may come and the use of sea dromes for landing.

Gold, because of its premium, will be more actively prospected and mined the world over and more economical refining will be vigorously sought. As the recent book "Textile Research, A Survey of Progress" presages, textile technology will make new contributions to an ailing, needy industry.

This year M. I. T. graduates the first public health engineers (trained in this country) as distinguished from sanitary engineers and the graduates of biology and public health courses. This course in public health engineering is indicative of engineering's growing contributions to and participation in health work, a process in which William T. Sedgwick so ably pioneered.

The list might be endlessly extended without exhausting the engineering possibilities of 1933. Without dwelling further on trends, however, let the wide-angle view dissolve into a close-up of the many specific projects which have been suggested. Before proceeding to their listing, it should be pointed out that the order in which they are presented is a rough geographic one — going eastward — and has no other significance.

ENGINEERING PROJECTS OF 1933

UNITED STATES

1. COLUMBIA BASIN STUDIES *Eastern Wash.*
For proposed straight gravity type dam, 420 feet high and 4,000 feet in length, to produce 1,000,000 horse power of primary and 1,000,000 of secondary power, and water to irrigate 1,200,000 acres. Estimated cost: $376,000,000 for entire power and irrigation project

2. OAKLAND BRIDGE *San Francisco*
Greatest bridge project ever undertaken. Cost: $75,000,000

3. GOLDEN GATE BRIDGE *San Francisco*
Length 8,943 feet, with a suspension span of 4,200 feet, world's longest. Estimated cost: $32,815,000

4. LOS ANGELES AQUEDUCT *Southern Calif.*
239 miles long; capacity, 1,500 second-feet; ultimate cost, $284,000,000

5. ALL-AMERICAN CANAL *Southern Calif.*
210 miles long; initial capacity, 15,000 second-feet; cost, $38,000,000

6. HOOVER DAM AND POWER PLANT *Boulder City, Nev.*
Highest dam in the world (730 feet), costing $71,000,000; power plant of 1,800,000 horse power capacity, costing $38,000,000. The entire flood control, power, and irrigation project will cost $165,000,000

7. BINGHAM TUNNEL *Bingham, Utah*
43,000-foot drainage-transportation tunnel affording a new entrance under mountains to Bingham Canyon from Tooele side. Interesting, but construction depends upon improved conditions

8. DOTSERO CUTOFF *Colorado*
Construction of 38.7 miles of new railway to shorten distance from Denver to Salt Lake by 175 miles, and use Moffatt Tunnel

9. MIDDLE RIO GRANDE CONSERVANCY PROJECT *Albuquerque, N. M.*
Furnishing flood protection to above city and other small towns in that territory, and irrigation of 50,000 acres. There is also a project on the Lower Rio Grande

10. MISSISSIPPI BRIDGE *New Orleans*
Main span consists of a 790-foot cantilever and 530-foot anchor arms, 135 feet above high water. Cost: $19,000,000

11. FLOOD CONTROL WORKS *Mississippi Basin*
Includes flood-ways, spillways, and levees on lower Mississippi River. $350,000,000 appropriated by Congress on May 15, 1928

12. SANITARY SYSTEM *St. Paul-Minneapolis*
Sewage system and purification plant for the Twin Cities requiring an outlay of $30,000,000

13. RIVER IMPROVEMENT *Missouri River*
To improve riverway from Kansas City to mouth and navigation from Sioux City to Kansas City. Cost: About $90,000,000

14. RIVER CANALIZATION *Upper Mississippi*
Plans call for a nine-foot channel from St. Paul to St. Louis. Cost: $125,000,000. In Ohio a barge canal is planned to provide canalization of the Beaver and Mahoning Rivers

15. WORLD FAIR *Chicago*
Its emphasis on scientific progress and its experimental architecture will make it notable

16. EASTERLY SEWERAGE TREATMENT WORKS *Cleveland*
This project will take care of sewerage treatment for the entire eastern portion of Cuyahoga County. It covers a large acreage of reclaimed land and is being transacted behind coffer dams. The pump house, instrument room, and inspection gallery is approximately 2,000 feet long, probably the longest building of its type in the country. A $5,000,000 post office is also under way

17. R. R. ELECTRIFICATION *Middle Atlantic States*
Electrification of Pennsylvania from New York to Washington. Curtailment this year?

18. BRIDGES *New York*
Lindenthal across Hudson River at 57th Street, costing $325,000,000 and giving the Baltimore and Ohio and other railroads access to New York City. Its construction is opposed by many groups. Another New York bridge project of interest is the Triborough Bridge

19. HUDSON RIVER VEHICULAR TUNNEL *New York*
On paper only

20. ROCKEFELLER CENTER *New York*
Largest privately financed construction operation ever undertaken. 2,000,000 square feet, or nearly 50 acres of rentable space, under roof of R. C. A. building, which contains largest tonnage of steel in any building

21. SWIFT-WARE RIVER WATER SUPPLY *Mass.*
Includes Quabbin Reservoir on Swift River, Quabbin Aqueduct (24.6 miles long — longest continuous tunnel in world), and Ware River intake

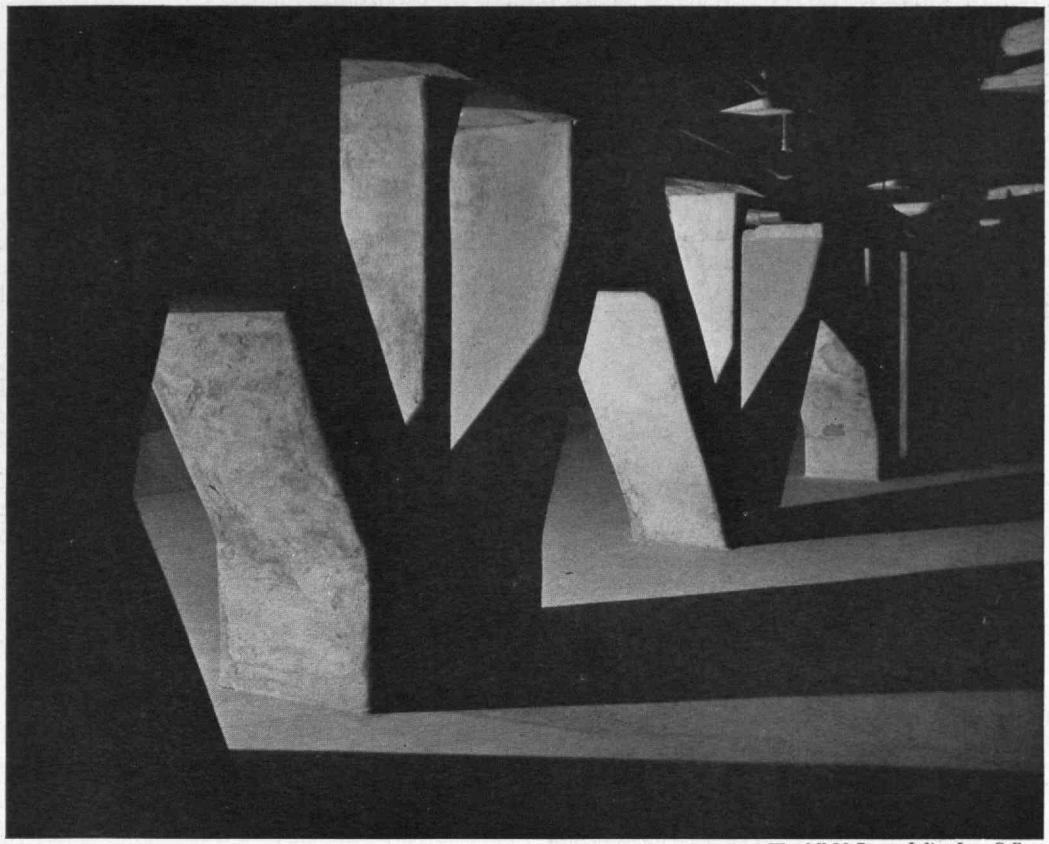
22. BOSTON-WORCESTER TURNPIKE *Mass.*
Providing for fast motor traffic on two separate roadways; practical elimination of grade crossings. Splendid example of advanced highway design

23. ELECTROSTATIC POWER *Round Hill, Mass.*
Van de Graaff 10,000,000-volt electrostatic generator which presages a new branch of engineering in addition to its promises as a weapon to attack the atom. See page 164 *ff.* Built by M. I. T.

24. EAST BOSTON VEHICULAR TUNNEL *Mass.*
Single-tube, two-lane subaqueous tunnel a little more than one mile long. To be opened this year. Notable new methods used in moving materials. Cost: $16,000,000

25. MADDEN DAM *Canal Zone*
Straight gravity type concrete dam, 220 feet high, 950 feet long, for water supply of Panama Canal and for incidental power development; 400,000 acre-feet of water storage and 8,000 kilowatt plant capacity of water power. Cost about $4,000,000

Other U. S. projects that might be briefly noted include the charting of the ocean floor off Puerto Rico, the drag-wire survey of Long Island Sound, the expansion of New York City's water supply system, the Navy's post-war destroyers, its proposed new aircraft carrier, and the use of airplanes on warships. There may be much discussion, little action, on the St. Lawrence Waterway project. The Chicago-to-the-Gulf Waterway ($27,500,000) will be carried forward to make Chicago a seaport.



Wendell McRae — Julien Levy Gallery

"Fantasy in Concrete," a photograph taken on the mezzanine floor of the Starrett-Lehigh building, New York City

FOREIGN

Note: The Editors of The Review acknowledge with gratitude the information on foreign works supplied by the Foreign Construction Division of the U. S. Department of Commerce.

1. BLUE RIBAND RACE — *North Atlantic*

Expected competition between Italy's *Rex* and *Conte di Savoia* vs. Germany's *Bremen* and *Europa* for the cream of the luxury fast express liner traffic of the North Atlantic

2. TRANSOCEANIC AIR SERVICE — *South Atlantic*

Regular Zeppelin service between Europe and Brazil with possible plane service

3. GOLD FIELDS — *Canada*

Rapidly increasing gold production, especially from large low-grade properties new to the region. See page 183 for full discussion of Canadian mining developments

4. GREAT BEAR LAKE DEPOSITS — *Canada*

Pitchblende (radium) deposits hold promise of cheaper radium and are the most extensive known on the North American continent. Silver ore is high grade and includes much native metal. See Review for January, 1933, page 138

5. PORT HOPE RADIUM PLANT — *Canada*

New process for production of cheaper radium

6. WATER AND SEWER SYSTEMS — *Canada*

A great water supply system for Toronto to cost about $14,000,000; reservoir and tunnel have been completed and the intake will be finished this year. Filtration plant ($1,384,000) will not be finished for a year or so. A trunk sewer system in Montreal is planned at a cost of $5,000,000

7. TRANS-CANADA HIGHWAY — *Canada*

Further operations are planned, particularly in the Province of Ontario. It is probable that the link between Pembroke and North Bay will be rapidly carried through

8. BRIDGES — *Canada*

(a) Across St. Lawrence at Lachine — Caughnawaga. Cost: $3,000,000. (b) Across Saguenay at Chicoutimi. Cost: $1,500,000. Another bridge of about the same magnitude is under way from North Shore of St. Lawrence to Island of Orleans

9. HIGHWAYS — *Mexico*

Constructing National Highway system at a cost of more than $3,000,000 a year — a link in the Pan American Highway

10. HIGHWAYS — *Argentina*

National Highway Law will provide about $18,000,000 a year for national roads and federal aid to provincial roads

11. CALLAO PORT WORKS — *Peru*

An entire new harbor and dock system is nearly completed; by an American firm

12. SUBWAY — *Great Britain*

Electrification of municipal lines in Glasgow, Scotland, embracing some 20 miles proposed, to cost £20,000,000

13. DOCKS — *Southampton, Great Britain*

Progress noted on new $65,000,000 docks

14. RAILROAD IMPROVEMENT — *Great Britain*

Great Western Railway plans expenditure of about $50,000,000 in new works — relaying 400 miles of track; re-tieing 100 miles

15. HOUSING SCHEMES IN BIRMINGHAM, NOTTINGHAM, AND LONDON — *Great Britain*

Involve an expenditure of more than £33,000,000; in the majority a four-year program in London for new homes for the working classes

16. NEW "GRID" SYSTEM — *Great Britain*

An electric power development covering virtually all of the United Kingdom, and including both power producers and distributors. The scheme dates back to about 1927. Existing

systems are involved, and any new construction which may be required will tie in with the plan

17. TEES (NEWPORT) BRIDGE *Great Britain*
Between Middlesborough and Durham, first vertical-lift bridge in Great Britain. Durham approach includes 218-foot, five-span, welded bridge over L. & N. E. Ry.

18. WATERWORKS *France*
Project approved for supplying 1,000,000 cubic meters of water for the municipality of Paris involves the expenditure of $80,000,000; the work to be effected in two sections; the first half to be finished by 1938 or 1940. Source of new supply is the River Loire, 85 miles south of Paris

19. RHONE DELTA *France*
Reclamation. (Little or no information is available here other than that 23½ square miles of area involved.)

20. RURAL ELECTRIFICATION *France*
Authorized by law in December, 1931, but execution of the works contemplated is moving slowly. Railroad electrification in France was also authorized by law at the same time, and the public works sub-committee of the Franco-German Economic Committee, meeting in Berlin in November, 1932, is said to have agreed that the principal task of the association of German and French firms for the carrying out of public works would be railroad electrification projects in southeastern Europe and the Near East, involving reconstruction of 7,000 kilometers of railroad and the expenditure of 17 billion francs

21. IMPROVEMENT OF OCEAN PORTS *France*
Extension, improvement, and restoration of French ocean ports at a cost of more than $40,000,000 under way, one-half of this amount will be spent at Boulogne-sur-Mer port. New port facilities to eliminate lightering at Cherbourg

22. CONSTRUCTION OF THE *Normandie* *France*
75,000 gross tons. 26,500-ton battle cruiser, *Dunkerque* also provided for

23. CANAL D'ALSACE *Rhine Valley*
Upper portion of an international power and navigation project from Basle to Strasbourg, where Rhine-Marne canal comes in — a distance of 136 miles

24. SUBWAY SYSTEMS *Rome, Italy*
35-mile subway system proposed to cost $35,000,000. A subway system is also being discussed for Milano

25. ALBERT CANAL *Belgium*
Construction costing about $39,000,000 progressing. Extensions proposed to involve $15,600,000 more

26. THE SCHELDT TUNNELS AND ANTWERP LAND DEVELOPMENT *Belgium*
Two tunnels to open up land across from Antwerp. Prizes are being offered for plans for the new development

27. ZUYDER ZEE *Netherlands*
Project to reclaim 500,000 acres from sea at cost of $250,000,000 upwards

28. BATTLESHIP *Germany*
Ersatz Lothringen, second of the pocket battleships

29. STROSTROEMSBROEN BRIDGE *Denmark*
Between islands of Zealand and Falster, a two-mile structure (longest in Europe) involving 29,000 tons of steel. Cost: $10,000,000

30. DRAINAGE OF PANCEVO MARSHES *Yugoslavia*
Opening up the country across from Belgrade. Pancevo bridge completed last year now stands without full access at its outer end

31. RECLAMATION PROJECT, STRUMA VALLEY *Greece*
This work includes levees, tunnels, bridges, and roads, and other construction, by which 450,000 acres of land will be made available for cultivation at an estimated cost of $22,000,000

32. NEW NILE DAM *Egypt*
Across the White Nile at Jebel Aulia, a point about 50 miles south of Khartum; to regulate flow of water in lower reaches of Nile so as to maintain irrigation along its banks even in the dry months, possibly resulting in the production of two crops a year instead of one. Estimated cost: £10,000,000

33. TRANS-PERSIAN RAILWAY *Persia*
A north and south rail line to cross a land four times the area of California with a population equal to Pennsylvania. Including portion of Trans-Persian already built, country's railway mileage is scarcely more than that of Rhode Island

34. 'IPCO PIPE LINE *'Iraq, Palestine, and Syria*
'Iraq Petroleum Company's building of Kirkuk-Rutbah-Haifa pipe line 531 miles across desert wastes to make Mesopotamian oil available at tidewater. Plans contemplate second pipe line Kirkuk to Haifa and possibly a third by British Oil Development Company from Mosul to Alexandretta. Cost: £10,000,000

35. MAGNITOGORSK *Siberia, U.S.S.R.*
Mining and metallurgical development in a corner of Siberia about 1,200 miles east of Moscow. Two blast furnaces now operating are largest in Europe and eventually there are to be eight in all, producing annually 2,500,000 tons of iron

36. POWER PLANT *Volga River, U.S.S.R.*
Plans call for dam two miles long, 98 feet high, and power station of 2,000,000 kilowatts capacity, and the irrigation of 11,250,000 acres. If project materializes, program calls for completion in 1937

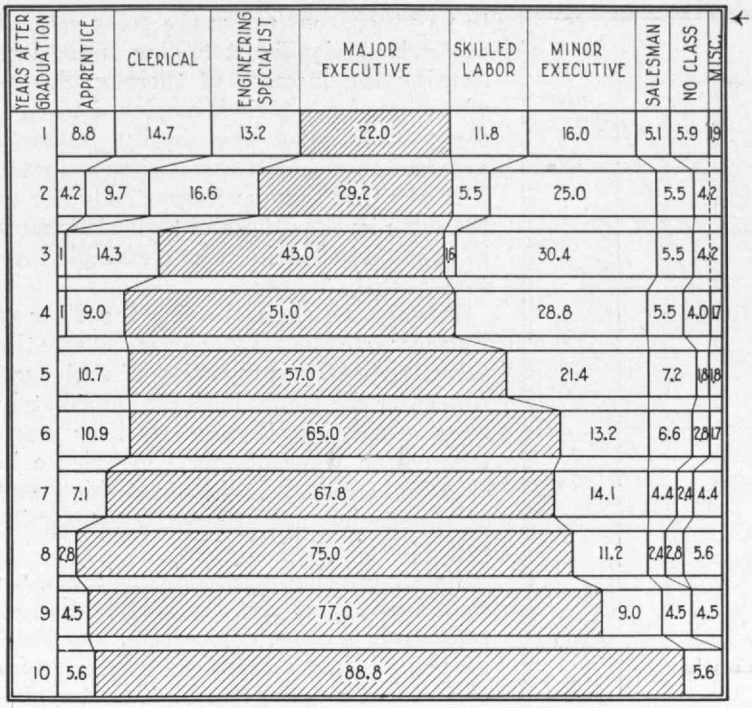
37. DNIEPROSTROY DAM POWER DEVELOPMENT *Ukraine, U.S.S.R.*
Gravity concrete type of dam on Dnieper River; 2,500 feet long and 140 feet high; 756,000 horse power wheels in nine units of 84,000 horse power each, operating under a head of 117 feet. When this begins operation it will be the largest, single, finished water-power plant in the world

38. PETROLEUM PLANT *Orsk, U.S.S.R.*
Complete refining plant to have ultimate capacity of 3,000,000 tons annually. Program announced for building 24 new cracking units in existing refineries. Total cost of program estimated at $50,000,000. In Khabororsk, Siberia, another cracking unit is planned to have a capacity of 750,000 tons annually

39. SUKKUR BARRAGE *Sind, India*
Regulating an irrigation dam on the River Indus. The main canal is fed from the dam's reservoir, total 1,040 miles in length with branch distributors and other connecting water courses increase the total to many thousands of miles

40. NANKING-PUKOW TRAIN FERRY *China*
The first of its kind in the Far East. This train ferry, carrying trains across the Yangtze River, marks a great stride toward up-to-date train service in China. Three movable bridges, each of 150-foot span, and a 2,400-ton boat providing three railway tracks to transport locomotives and trains are features of this $3,000,000 scheme; the cost to be defrayed from the British Boxer Indemnity Funds

41. GOLD MINING *Papua, New Guinea*
Region virtually inaccessible except by airplane and all equipment, including a gold dredge, transported by air over mountain range



← *Occupational distribution of graduates in family businesses*

Shall I Hire My Son?

A Study of the College Graduate and the Family Business

By Erwin H. Schell

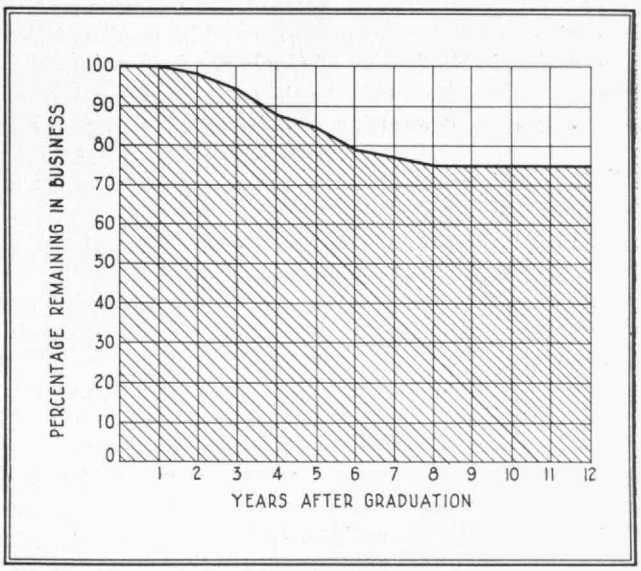
ONLY those teachers whose privilege it is to confer with fathers of young men in college can appreciate the perplexities encountered in the problem, "Shall I take my boy into the business?" When there is no question of compatibility between father and son, parents fear that their own desires may be influencing their better judgment. When there is ample evidence of ability, they hesitate to influence a promising career. Even when other avenues of employment are not easy to discover, fathers ask, "Should I not let my son stand on his own feet, to find and establish himself unaided, just as I had to do?"

More than this, prevailing comment has been far from reassuring. We have all heard of the boy who was taken into his father's establishment "because he could not get a job anywhere else" — "because he was such a trial to his parents that they wanted him where they could keep their eyes on him" — "because his mother insisted that he have a position near home" — "because he was not very strong." We have all heard of the boy who entered the family business "because I won't have to keep regular working hours and I can have long vacations in the summer" — "because I'm not so likely to be fired" — "because I can skip the heavy work and have a desk in the main office" — "because if I get in a jam, mother will stand up for me."

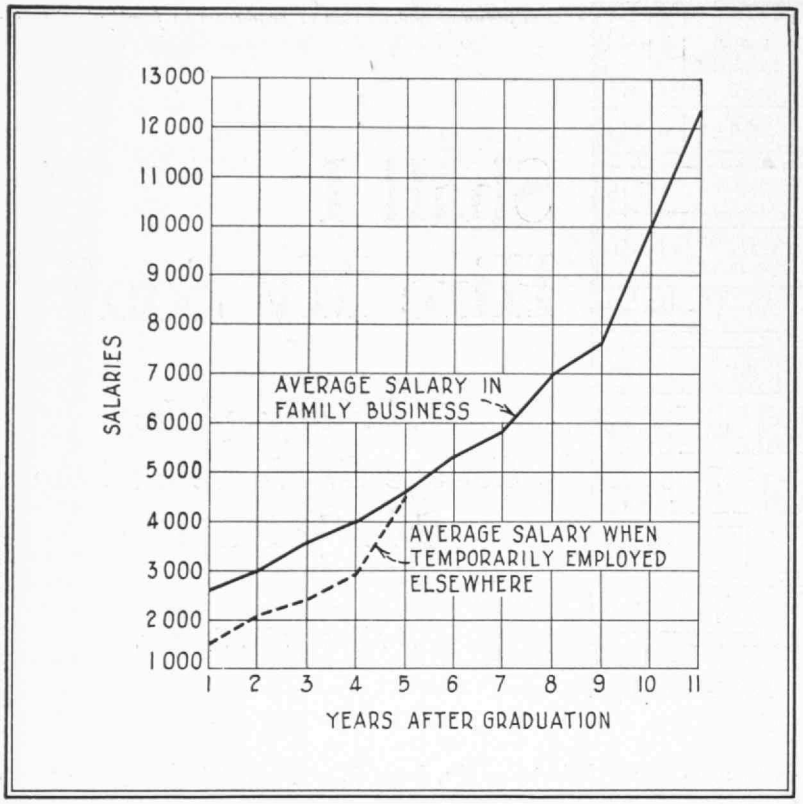
Assuming that a parent has not been thus deterred, there still remain such important questions as these: "Should I offer the boy a position at once or should he be given the initial benefit of a few years' experience in another industry or establishment?" "Should I arrange for him to start in at the bottom of my business without favor or assistance from me, giving him unusually difficult tasks with which to test his mettle, or should I conduct his training under my own supervision?" And finally, "Should I pay him more or less than the going rate?"

Unfortunately, logic is not helpful in settling these questions. Good arguments may be had on either side. But more objective data have been made available through a special study of 134 graduates of the course in Business and Engineering Administration at the Massachusetts Institute of Technology. These students, of the classes of 1917–1929, inclusive, entered their respective family businesses. In company with something over 80% of their classmates in this course, they submitted in 1930 detailed records concerning their post-graduation history.

The first study of these data was directed toward the relative success, as measured by continuity of service, of these men who entered the family business. The chart entitled *Rate of Departure from Family Businesses* gives



Rate of departure from family businesses of graduates entering employment immediately after graduation



Average salaries in family businesses

the history of 93 such graduates from varying classes, who entered the parental establishment immediately upon graduation. It is significant that the withdrawals, even among the graduates having the longest industrial experience (12 years), do not exceed 25%. This proportion is considerably lower than that of the average graduating student.

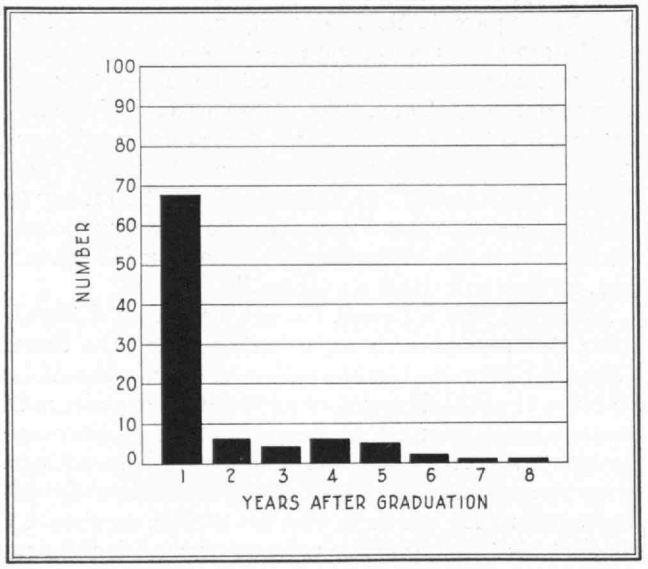
Of course, it may be argued that nepotism may account for this exceptional tenure of occupation. Were this a primary factor, it would follow that such men would be retained irrespective of fitness, but presumably would be given positions freed from burdens and hazards of executive responsibility. The chart entitled *Occupational Distribution of Graduates in Family Businesses* shows, however, that such graduates were rapidly raised to executive positions. Indeed, this advance is much more rapid than that of any other group of graduates, although some correction must be made for the fact that most family concerns are of but medium size, while in the larger concerns so-called "minor executives" might well have equal or greater responsibilities. While this chart proves nothing with respect to the type of training which these young men received, it is logical to expect that they had more, rather than less, benefit of contact with their fathers and other major executives.

Perhaps the most interesting findings center upon the chart of *Average Salaries in Family Businesses*. Here again, we find that young men who have had the opportunity to work with their fathers were receiving relatively high remuneration. Other comparative studies indicate that this group ranges in the vicinity of the upper tenth of incomes in each graduating class. There is no question but that fathers generally have decided to pay their sons above the going rate. A particularly significant finding is the line showing the incomes of those graduates who were, for a period, employed in concerns other than the family business. Whereas their initial earnings were lower, it is seen that these averages finally rise to the same level as those of their classmates in parental industries, whose example they subsequently followed.

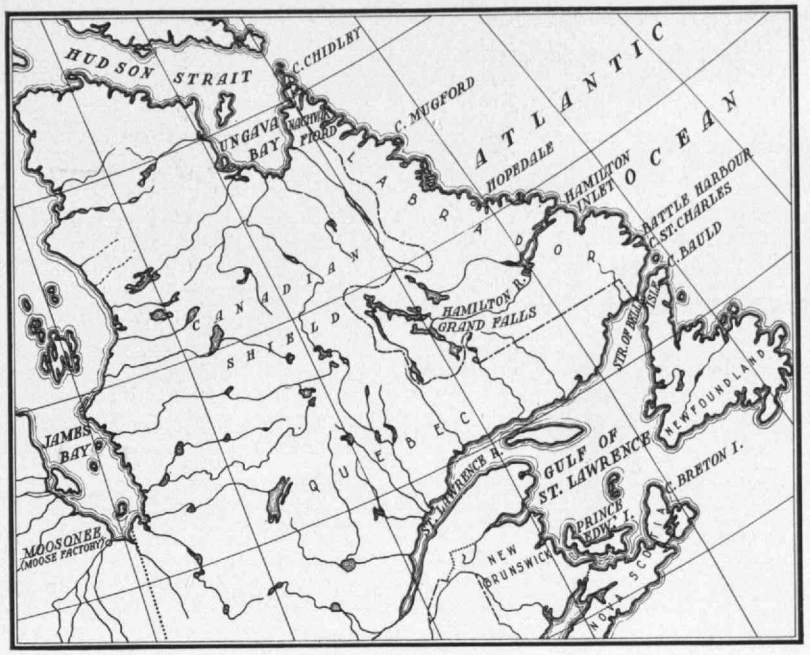
Finally, the chart showing the *Time of Entrance into Family Businesses* reflects the surprisingly large proportion of such men who enter the family business immediately upon graduation. Though we hear much talk of the value of initial experience in other industries, it is clear that this group of parents has not attached great significance to this point of view.

Before drawing a general conclusion, we should point out that the combination of training in science, engineering, and business administration received by this group of 134 men especially fitted them for ultimate industrial activities of a managerial nature. The specialized courses in such subjects as marketing, finance, production, accounting, and business law, as well as plant inspection trips, industrial summer work, and the use of the so-called business case problems established unusual familiarity with industrial realities. In short, the group was highly selected and well-equipped to cope with business problems.

If tenure of service, extent of responsibility, or remuneration are any criteria, it is clear that such young men can and do make good in the parental business. The crux of the matter lies in a single question, "Does the boy view the control of wealth as a privilege or a responsibility?" On this fundamental concept pivots his career in the family business.



Time of entrance into family businesses. The number entering immediately after graduation is surprising



Plane Trails Over Labrador

Mapping the Northeast Corner of North America

By Harold G. Crowley

SINCE Newfoundland opened Labrador to the prospector and since the opening of the Hudson Bay route (with grain flowing from Churchill to Europe around Cape Chidley), Labrador's importance has been growing in the public mind in a way that must warm the cockles of Sir William Grenfell's heart. Stories of gold hidden in its wilds are of growing frequency; tourists and sportsmen are discovering the peninsula's magnificent fiords, its "Shining Tops" and Tongaks; geologists and naturalists are finding it a fertile laboratory. ¶ *It is particularly fitting, therefore, that The Review report on the recent aerial surveys that have been under way to map accurately the country's coast for the first time. It was Joliet, discoverer of the Mississippi, who first rudely charted this coast; the expeditions of which Mr. Crowley was in charge of flying may, therefore, be said to have continued and completed his work.* — The Editors.

THE coast of Labrador, stretching in a ragged and imposing line for over 600 miles from Belle Isle Straits to Baffin Land, has never been well charted. Its southern half is frequented in the summer by the Newfoundland fishing fleet and consequently is known to these mariners who have, during the past 40 years, been instrumental in forcing the Newfoundland Government to do some survey work in the region. The northern half can be classified as uncharted, on the basis that a bad chart is worse than none at all. Fishermen rarely go there, the Hudson Bay Company's vessel makes only one or two annual trips between the ice break-up and the stormy fall weather, and what mail comes to this section arrives either by the latter vessel or by dog team during the winter.

Chasm Lake, a very desolate spot near Nachvak, in northern Labrador

Some three years ago, Sir Wilfred Grenfell, the man who has probably done more for Labrador and its people than Labrador's own meagre government, and who has been known for forty odd years as the "Coast Doctor," originated, in company with Dr. Alexander Forbes of Boston, the plan of a careful survey in this northern region. Both are public-spirited men and both are good sailors. Equipment was obtained, personnel was assembled, and in June, 1931, the first expedition got under way from Boston with sixteen people on the fine auxiliary schooner Ramah. The survey begun by the first expedition was continued last summer, and for both expeditions I had charge of air operations.

Aerial mapping was the main purpose of both trips. The results

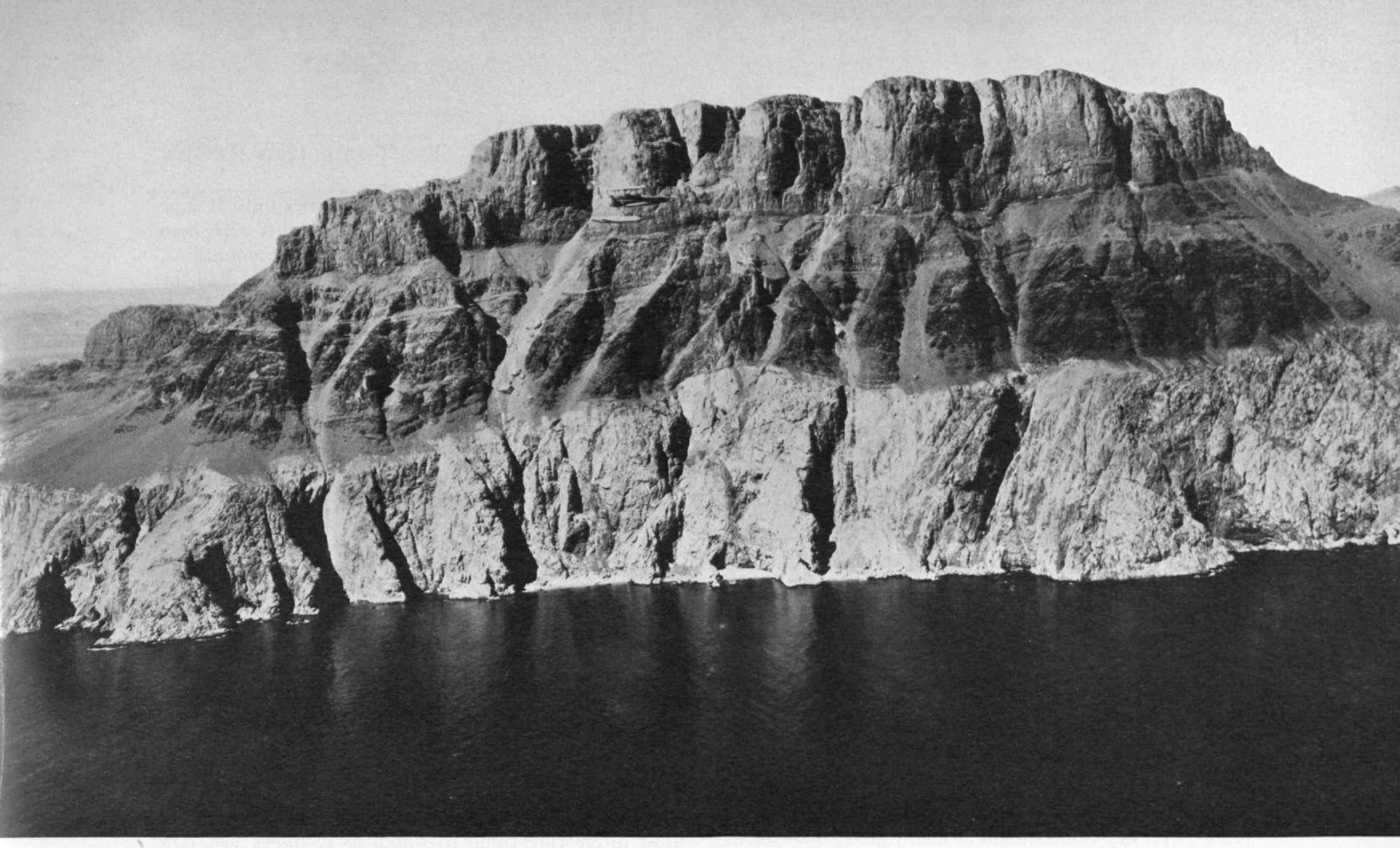
Grand Falls on the Hamilton River, which have a vertical drop of 310 feet (Niagara is only 167 feet). It was near here that Mr. Crowley found the stranded prospectors. *See page 192.*

of this mapping, when published, will serve several general purposes, of which probably the most important will be the locating of at least one good harbor near the northern end of the coast for the use of ice-breaking grain boats, and others, as a harbor of refuge. The Canadian Government is experimenting with the transport of its grain to Europe via an all water, or practically all water route, out of Hudson Bay, through Hudson Straits, around Cape Chidley and then south into the regular steamer lanes. An accurately charted harbor near Chidley, which is pretty much the bottle neck of the whole system, will be of inestimable value to such a project. A second definite use for such charts will occur when tourist steamers travel this region, as they eventually will, because the coast scenery is awe-inspiring and certain parts of it are unequalled elsewhere in the world. Cape Mugford, about three quarters of the way up the coast, has been described by A. P. Coleman, internationally known geologist, as one of the grandest bits of coast scenery in the world, and Nachvak Fiord, which is nearby, is, in the eyes of some, unequalled by any of the Scandinavian fiords. Other uses for these charts will come in time as the country may some day support mining projects and development and another possibility is that of air transport companies using this section as a North American base for their arctic or sub-arctic mail routes into Europe.

An aerial photographer, a mechanic, and myself flew north in a Wasp powered Fairchild seaplane on the first expedition. About halfway up the Labrador Coast we had a rendezvous with our schooner and while she waited, we flew farther north on reconnaissance for a suitable base. Such a place affording good anchorage and lee for schooner and plane was found, air photographs of it were taken, and these subsequently developed back on the schooner were used to guide her, in a dense fog, to the very spot. We then flew there, erected a darkroom on shore near a fast running brooklet, and were ready to start our survey.

The type of survey used employs oblique aerial photography. There are three distinct methods of air mapping. The first and best known one uses vertical photography, and in this system the camera is pointed vertically downwards, or as nearly so as the combined skill of photographer and pilot and temperamental air currents will allow, and photographs are taken, one overlapping the other as the plane flies along on a straight course. The photographs are then fitted together to form, in effect, one big vertical picture of the country being mapped.

The second is known as the Canadian Grid and uses oblique photography. This is also quite simple. The camera is pointed slightly down from the horizontal (about 10 degrees) and the exposure is made. The resulting picture shows the terrain stretching away from nearly under the plane to the horizon. A perspective grid is now fitted over the picture (the grid having been accurately made from knowledge of the focal length of the camera, the exact height of the plane and the tilt of the camera, as determined by the amount of margin showing above the horizon) and any or all of the desired geographical features can now be drawn on a square grid. This system is widely used in flattish country, and gives good results although it is obviously decidedly in error for an uneven terrain.



An expedition plane flying in front of the 2,500-foot cliffs of Cape Mugford, one of the grandest bits of coast scenery in the world

The third method, and the one we used, employs oblique photography also. It was devised by geographer O. M. Miller of the American Geographical Society and is sometimes called "planetabling from the air." Mr. Miller, who accompanied us on our 1931 expedition through the collaboration of the American Geographical Society, witnessed his system of survey in actual use for the first time. A geographical fix by star sight of a base line of about two thousand feet is made, and from both ends of this base bearings are taken of three prominent and comparatively nearby points. The exact position of these points are then easily determined. If two oblique air photographs are now taken, with terrain common to both, the exact positions in space of the camera at the instants the photographs were made can be determined trigonometrically if the focal length of the camera is known and if our three known points appear in both pictures, and also the position of any unknown point appearing in both prints can be definitely fixed by intersection. From our three main points rounds of angles are taken to distant points. The positions of these distant points are then calculated and they, in turn, become known points for further intersection. In this way the system of known points can be stretched for a long distance. In practice, and in our case, another local system of ground triangulation was created some fifty miles north of the original one. From this region many irregularities in the skyline common to the initial system could be seen, and these common points accurately tied both systems together. A tide gauge installed near the base line allowed the Z coördinates (from mean sea level) of all desired points to be obtained. After as many points as are wished for are known, the topography is drawn by hand, as in the Canadian Grid System, with the exception that the knowledge and use of all three coördinates result in a contoured map.

The area covered during the 1931 expedition was roughly an equilateral triangle of some ninety or one hundred miles on each side. The flying required only about fifteen hours and approximately 600 pictures were taken. The camera used is, of course, strictly a mapping camera, and is known as a Fairchild K5. It uses rolls of film about 75 feet long, takes a picture 8 inches by 10 inches, has a fixed infinity focus, and has no adjustments other than shutter speed and the optional use of filters. Incidently it is quite heavy (about 40 pounds) and the photographer who uses one steadily for several hours certainly realizes that he has been working. One advantage of this method of mapping is that the flying requirements are very elastic — the flying course made good need not be absolutely straight and neither must the altitude be maintained precisely. In our work we simply flew parallel flight lines roughly ten miles apart using the camera steadily in such a way that all ground was covered by at least two photographs. The altitude was held at 7500′ near the coast and for added safety, at 9000′ in the interior. Our darkroom, fairly well equipped, allowed for the occasional testing of negatives during the work and the ultimate developing of all of the mapping film as well as a good deal of the printing after the region was covered.

IN THE spring of 1932 it was decided to continue the survey down the coast for another 150 miles, and so last July I again set out with a photographer and a mechanic for the country that was beginning to look

The head of Nachvak Fiord, looking south. See map on page 177

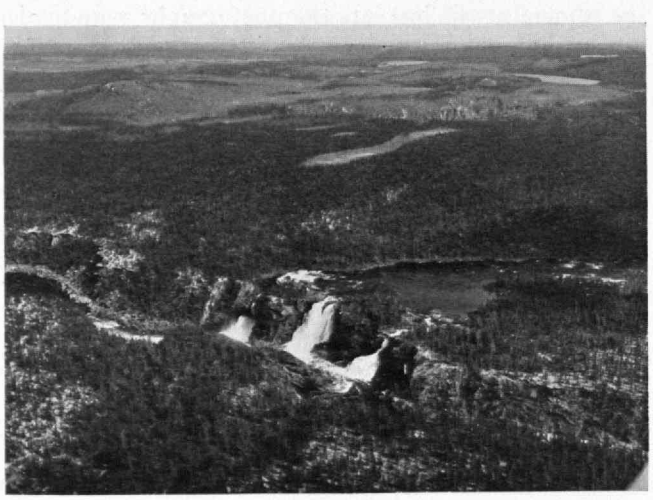
like home. The work did not take long on this last trip. The area as compared with the first summer's work of 4500 square miles was only 2500 square miles, the flying time was only thirteen hours and 330 photographs were taken. The problems and inconveniences were much the same, however, as fog and sea ice prevailed a large part of the time. Photographic weather must be nearly perfect — no clouds, or at least none but the highest and most sparsely scattered cirrus can be tolerated — and as a general rule there should be a stiff breeze blowing as otherwise haze or smoke will obscure the horizon of many pictures. Fog was very common both summers and waiting and waiting for it to clear is exasperating. This past summer we were hampered somewhat by pack ice which did not get clear off the coast until August first. This constitutes quite a hazard for seaplanes as a series of wind shifts could conceivably bring the pack into the most sheltered cove and the probable result of this would be the loss of the plane. Fortunately nothing of the sort happened although it was twice necessary to use extreme care in landing in a lane of open water and several times to follow erratic paths taking off to keep clear of broken ice.

Both trips were completely free of motor trouble. A heavily loaded seaplane requires considerable run to get off and when the water is choppy its engine takes a real beating with solid green water going into a fast moving propeller and salt water coming all over a hot engine. The Wasp did not ask for mercy at any time but the propeller tips would get very rough and eroded every few take-offs and required constant smoothing. I subsequently found that a thin layer of ambroid cement on the tips would lengthen the period between smooth-ups a great deal and this, incidently, is the only material I know of that does check propeller corrosion in salt water. The plane is serviced and its motor checked very conveniently from a schooner's deck, by simply tying both pontoon bows hard against the schooner's side and then placing several big planks across the tops of both pontoons. This makes an ideal platform to work on and also serves the purpose of catching any parts or tools which may be dropped.

Flying in the northern part of Labrador is strictly a matter of having an engine that will keep running. From the air the country appears inhospitable to a remarkable degree. Apparently an ancient plateau, it has been cut and worn by glaciers and rivers until it now appears as an area studded with mountains with here and there possibly a short range of similar mountains. One gets the impression that these hill tops are all of the same height and of about four thousand feet. There seems to be very little system to the ranges and a surprising lack of continuity to the drainage — rivers double back upon themselves and many lakes apparently have two or more outlets.

IN THE summer of 1931 I witnessed an unusual meteorological event. While flying northbound toward Cape Chidley at about 4000′ altitude I noticed an occasional cumulus cloud (this is the fluffy wool-ball type) at 5000′ altitude. Far above this at possibly 12,000′ or even 15,000′ was a uniform layer of dark cloud. I flew above the cumulus for awhile and noticed that the high layer came continually lower until in the distance, out over the sea and near Baffin Land, it appeared to come down to the level of the cumulus. Flying down below the cumulus at this time a peculiar haze appeared to be forming on the surface of the sea at a point just under the junction of the two layers. While I watched, it grew and became more distinct and very shortly became recognizable as a patch of sea fog probably twenty miles in extent. This birth of fog was a most interesting thing to watch as it shows just how fast bad flying weather can set in.

The past summer brought to light the tragic ending to an exploration party in the interior of Labrador. In the spring of 1931 two Americans from New York, in company with a coastal native whom they employed as guide, attempted to cross the peninsula on foot and by canoe. The party left a Hudson Bay Company's post in Ungava Bay and planned to travel about nine hundred miles to the Atlantic Coast before the fall freeze-up. Last fall they did not come out and it was realized by the local people that they never would come out, in all probability. Last July, while I was waiting at the town of Hopedale for the ice to open up to the north, an Indian gave me to understand that he had found the body of a white man far in the interior. I asked him how far and he said "Seven days." (*Continued on page 190*)



Upper Unknown Falls on a branch of the Hamilton River, 20 miles south of Grand Falls

THE TREND OF AFFAIRS

IN THIS SECTION: *Old and New Chemical Gardens (181); A Summer Refrigerating Plant Heats a Building in Winter (182); Gold and Radium Mining Boom in Canada (183); Recent Increases in our Knowledge of Vitamins (184)*

Chemical Flower Gardens

By Tenney L. Davis '13

DEPRESSION flower gardens which have recently appeared in so many homes, which are being discussed in business offices, in the newspapers, and at teas where the ladies foregather, may be prepared by mixing:

6 tablespoonfuls of salt
6 tablespoonfuls of bluing
6 tablespoonfuls of water
1 tablespoonful of ammonia water,

and pouring the mixture, after thorough mixing, over a clinker in a suitable dish. Not quite all of the salt will dissolve, but let the undissolved portion be poured out along with the rest. Instead of a clinker, a piece of coke or of common brick, or a mass of coal ashes may be used, but a clinker has the right degree of porosity and is probably best. After the clinker has been wet with the liquid, drop on it a few drops of mercurochrome solution or of red ink or green ink, or of any other colored liquid which is handy. But do not use iodine, for this reacts with ammonia water to form the dangerously explosive nitrogen iodide, a black powder which is safe as long as it is wet but explodes with a loud report from very slight shock when it is dry. Within 10 or 15 minutes after the materials have been brought together, a coral-like growth begins to appear on the clinker. This increases rapidly; within a few hours the clinker is entirely covered with a growth which is colored in part by the bluing and in part by the mercurochrome or other color which was used. The color of the bluing fades in time and changes to brown because of a chemical reaction with the ammonia. The colors produced by aniline dyes, ink, mercurochrome, and so on are permanent.

The growth also tends to form on the edges of the dish and will climb up and over them unless they have been rubbed with vaseline. The growth will not extend beyond the vaseline.

A "Depression Garden" of the year 1706 — an old engraving discovered by Contributing Editor Tenney L. Davis and described adjacently

The "depression flower garden" is a capillary phenomenon involving the tendency of ammonium salts to "creep." The saturated solution deposits crystals around its edges and upon the clinker where the evaporation is greatest. The crystals are porous and act like a wick, sucking up more of the solution by capillary action. The solution thus sucked up evaporates to produce more crystals, more wick, and more growth. The addition of a little more ammonia water to the dish will produce more growth after the first growth has stopped. Or the whole may be allowed to dry and may then be kept without further change.

The idea of the "depression flower garden" is by no means new. In the years 1705, 1706, and 1707, the chemist, Nicholas Lemery, published in the *Memoirs* of the French Academy papers in which he described "vegetations" produced by the spontaneous evaporation of salt solutions. His papers were accompanied by engravings of which we reproduce one below, in particular the one which seems to be the most handsome and which was first published with Lemery's paper of 1706. Lemery secured his vegetations by the use of salts of iron and wrongly concluded from his experiments that iron is therefore necessary to the growth of plants.

One who makes a depression flower garden might be tempted to infer that ammonia is necessary for the growth of plants. This would be a wrong inference from the experiment, but it would be a correct judgment, for it is true that ammonia is essential to the growth of nearly every kind of vegetable organism.

The "mineral flower garden," which florists sometimes sell or display in their windows, depends upon an entirely different principle, that of osmosis, or of osmotic pressure. A solution of sodium silicate, or "water glass," is poured into a jar or globe, and crystals of readily soluble salts of certain metals which form colored and insoluble silicates are thrown in and allowed to sink to the bottom. Growths resembling marine plants spring up from these crystals and in the course of a few minutes climb rapidly upward through the

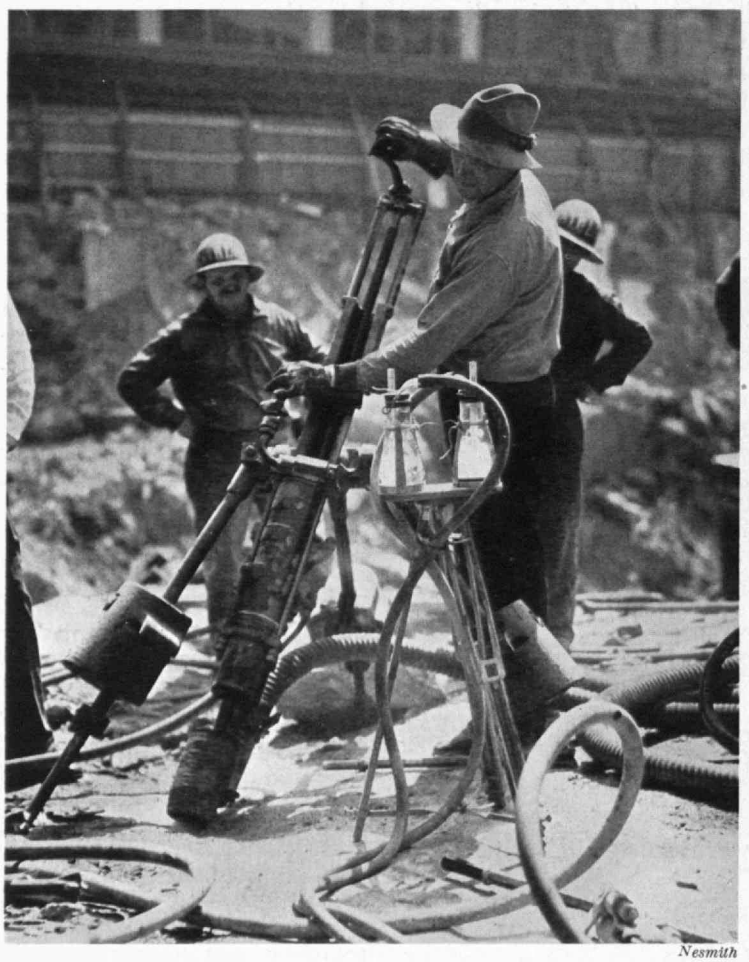
liquid, often branching and curving, producing an effect which might lead one to believe that he sees exotic algæ growing in an aquarium. The experiment works best if the solution of water glass is diluted to a specific gravity of about 1.10.

Ferric chloride produces a brown growth; nickel nitrate, grass green; cupric chloride, emerald green; uranium nitrate, yellow; cobaltous chloride or nitrate, dark blue; and manganous nitrate and zinc sulfate, white.

If one of these salts, say ferric chloride, were dissolved in water and the solution were mixed with a solution of sodium silicate, there would be an immediate precipitate of brown ferric silicate. When the crystal of ferric chloride is dropped into the sodium silicate solution, it immediately commences to dissolve and tends to become surrounded with a solution of ferric chloride. But the solution of ferric chloride at once produces a precipitate at the points where it meets the solution of sodium silicate. The result is that the crystal of ferric chloride, surrounded by a solution of ferric chloride, is enclosed within a little sac or skin of precipitated ferric silicate. More of the crystal dissolves and the solution within the sac tends to become more concentrated. Water from the silicate solution diffuses through the skin, tending to dilute the concentrated solution of ferric chloride and building up an osmotic pressure within the sac, a pressure which finally breaks the skin, at the top where the external pressure is least, and releases more ferric chloride solution which comes into contact with the silicate solution to produce a new skin. And the process repeats itself rapidly, producing a growth which is fast enough for the eye to see.

The experiment works best with readily soluble salts, for these dissolve more rapidly and they form more concentrated solutions which have greater osmotic pressures.

The middle "flower gardens" may be kept indefinitely if they are protected from the air and not shaken or disturbed. The carbon dioxide which is present in the air, if it has access to the silicate solution, would make the solution become milky in the course of a few weeks.



Nesmith

Eliminating the silicosis danger in drilling operations. The drill is equipped with a dust-eliminator, developed for the foundation drilling at Rockefeller Center. Note the bottles on tripod which measure the amount of dust breathed by the workers

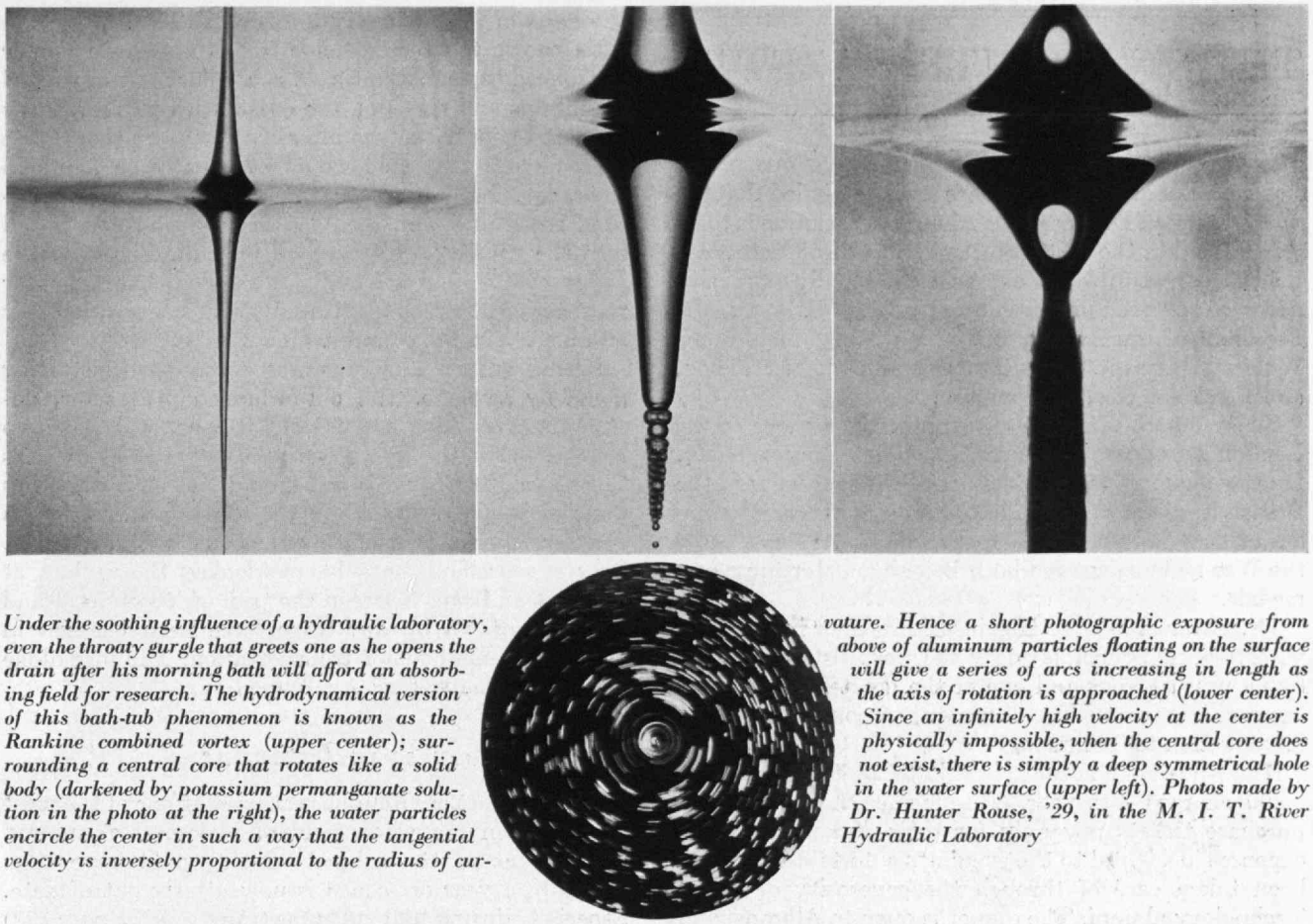
Heating by Refrigeration

SOUTHERN California Edison Company's electrically heated and cooled office building in Los Angeles is tangible evidence of progress in the engineering art of air conditioning. Conceived and executed in the face of skepticism, this system, in which a summer cooling system is made to supply heat during the winter, has proved successful.

Although the building is equipped with direct electrical heating units placed under windows and indirect heating devices near the ventilating fans, heating the building by means of its refrigerating equipment has been found to be efficient and more economical. In planning the air conditioning system, it was decided to include additional equipment for heating tests on the heat pump principle. The only extra device necessary for this experiment was a heater, through which the condenser water could be circulated for warming the air supplied to the building.

In operation, the refrigerant gas, methyl-chloride, after being compressed, is passed to the condenser where heat is removed. This heat is absorbed by the condenser water, which is then pumped through a fin-tube heater located in the path of the building air supply. The air is thus heated and the temperature of the condenser water is lowered. The refrigerant, now in liquid form, is then passed through an expansion chamber to the cooler, where it again is converted into a gas, thereby absorbing heat from the water circulating through the cooler. The water of the cooler finally passes through an air washer on the roof of the building, where it absorbs heat from the outside air. Thus it will be evident that the heat absorbed from the air by the cooler water is in turn absorbed by the refrigerant and then by the condenser circulating water, and is finally transferred to the air supply of the building.

This method is practicable wherever heat is available from bodies of water or from the atmosphere, provided the temperature of the source is not too low. This system of heating, the



Under the soothing influence of a hydraulic laboratory, even the throaty gurgle that greets one as he opens the drain after his morning bath will afford an absorbing field for research. The hydrodynamical version of this bath-tub phenomenon is known as the Rankine combined vortex (upper center); surrounding a central core that rotates like a solid body (darkened by potassium permanganate solution in the photo at the right), the water particles encircle the center in such a way that the tangential velocity is inversely proportional to the radius of curvature. Hence a short photographic exposure from above of aluminum particles floating on the surface will give a series of arcs increasing in length as the axis of rotation is approached (lower center). Since an infinitely high velocity at the center is physically impossible, when the central core does not exist, there is simply a deep symmetrical hole in the water surface (upper left). Photos made by Dr. Hunter Rouse, '29, in the M. I. T. River Hydraulic Laboratory

designers note, is not adapted for the production of high temperatures. It works at greatest efficiency where the difference between maximum and minimum temperatures is small. It is suitable for the climate of California, and likewise should be efficient in some of the southern states.

We have all heard the wise-acre suggestion that a mechanical refrigerator be put at the North Pole and run backwards to supply heat. Southern California Edison, with its reversible plant, has proved that this is more than a joke. Its refrigerator-heating equipment is a unique contribution to air conditioning.

Gold and the Riches of Canada

CANADA'S mineral resources, including gold, the promising pitchblende discoveries at Great Bear Lake, and the world's largest known reserves of nickel, have given the Dominion a leading place in the mining world. Exceeded only by the great Transvaal fields of Africa in production of gold, Canada is expected to strengthen her position as the world's second largest producer by an increase in operations this year.

Although official figures are incomplete, a conservative estimate places the value of Canada's gold production for 1932 at $63,500,000, compared with $55,700,000 in 1931. A forecast for 1933 indicates $70,000,000.

Canadian mining has held the attention of the world since 1906, when the discovery of silver in northern Ontario marked the opening of Cobalt, the most spectacular silver camp of modern mining history. Then came the discovery of gold at Porcupine, a hundred miles north of Cobalt, and now one of the most productive gold fields in the world.

Although the present economic conditions have placed a handicap on mining developments in general, the search for gold and the development of discoveries has, as might be expected, gained a new impetus which extends from the unemployed men who are now washing gold from the old placer workings in the mountains of British Columbia, to the most recent mining operations in the central and eastern Canadian fields.

The economic benefits of mining operations in Canada have particular significance at a time when the need is great. Prospecting and the development of mines have given thousands of men employment during the past year, and the indications are that the number will increase this year. Manufacturers of mining machinery and supplies have likewise benefited.

The important gold mining developments now commanding attention are in northern Quebec, Ontario, and Manitoba. The famous Rouyn Field near the western border of Quebec increases in promise. Recently gold has been found in the Bell River, northeast of the Rouyn Field. New finds in the Woman River district of Ontario, 100 miles north of Sudbury, indicate important gold deposits, and preliminary developments are progressing. The more inaccessible gold mines in northern Manitoba are being developed despite handicaps of distance and cost of transportation. (*Continued on page 184*)

THE INSTITUTE GAZETTE

Annual Alumni Dinner

ALUMNI of the Institute are again reminded that the Annual Dinner of the Alumni Association is to be held in the Hotel Statler Ballroom on Saturday, February 4, at 6:15 o'clock. An exceptionally attractive program has been prepared by Dr. Allan W. Rowe, '01, President of the Association. The speakers include Sir Willmott Harsant Lewis, Dr. Walter Bradford Canon, and President Karl T. Compton.

Sir Willmott is the Washington correspondent of the London *Times* and is a journalist famous the world over. He was made a Knight Commander of the Order of the British Empire in 1931 and has been decorated a Chevalier of France's Legion of Honor. For his service during the War he was awarded both British and Japanese war medals.

Dr. Cannon, George Higginson Professor in the Harvard Medical School, is one of the most distinguished of living physiologists and one of the greatest scholars in the medical world. Dr. Compton, of course, needs no introduction to Technology.

The price of the dinner is only $2.50 compared with $4.00 charged last year. This means that those who purchase tickets pay only for their dinner. All other expenses incidental to the evening's entertainment have been taken care of through the generosity of a few Technology alumni. The dinner is open to Alumnæ and Alumni of the Institute and non-Technology men will be welcome as guests.

TREND OF AFFAIRS

(*Continued from page 183*)

British Columbia, once an important gold producer, again looms as a significant field. Improvement in methods of mining has resulted in an increase in production from several mines. Meantime, prospecting by airplane is being carried on in hitherto inaccessible regions.

Successful experiments with a new and large type of dredge is again focussing attention on the famous Yukon placer deposits. Increased production of gold from the placer gravel of the rivers is expected when these dredges begin operations.

The spectacular discoveries of pitchblende, from which radium is extracted, have overshadowed the significance of the rich silver discoveries at Great Bear Lake, for in this sub-Arctic mining camp seems to lie the world's best hope for an increase in its supply of radium. As for showings of native silver and cobalt, the field at this stage of development appears no less promising than was Cobalt in its bonanza days.

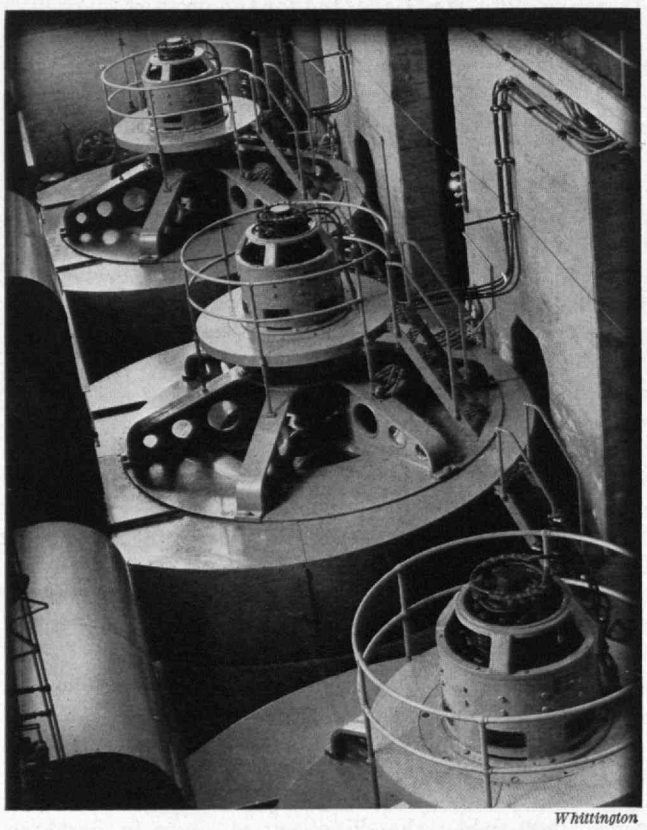
Canada has vast bodies of copper ore, some of it lying within the Arctic Circle. It also contributes materially to the supply of platinum, selenium, bismuth, and lead.

While Labrador is a possession of Newfoundland, its possible significance in mining must be considered on the basis of its contiguity to Canada. This lonely and little-known territory extends from the eastern border of Quebec to the Atlantic. It is a wilderness of rugged mountains and fiords on the coast, with barren, thinly timbered country in the interior. For years there have been reports that gold would eventually be found in Labrador. From time to time venturesome prospectors, some of whom died in their efforts, penetrated into the country and searched in vain. Recently, the government of Newfoundland opened Labrador for prospecting, thereby starting feverish preparations for an invasion of the country. (See page 177*ff*.)

Spring will see numerous prospecting parties starting north by airplane. The old-fashioned prospector, dependent upon dog teams and canoes, will have no chance. What the flying prospectors will find remains to be seen. They will look for gold. Whatever else lies there may be overlooked for the time being. Men with eyes for silver only at first overlooked Porcupine's gold. Others, searching for gold, overlooked the radium at Great Bear Lake. Between the trail of '98 on foot, and the trail of '33 by air, there have been changes in mining and methods of transportation. The lure alone remains unchanged.

Recent Progress in Vitamins

THE subject of vitamins is at present one of the most active in the whole field of biological chemistry. An account of the subject which would have been adequate a year or so ago is now utterly out of date. Especially during 1931–1932 the (*Continued on page 192*)



Whittington

Hydroelectric generators at the base of Horse Mesa Dam on the Salt River, near Phoenix, Ariz.

Miracle Worker, AGE 8

HIS little hands hold the instrument tightly; his small, confident voice speaks eagerly into the mouthpiece. And as simply as that, he talks to his friend who lives around the corner, or to his Granny in a distant city . . . achievements which, not so many years ago, would have seemed miraculous.

These miracles he takes as a matter of course, in the stride of his carefree days. You yourself probably accept the telephone just as casually. Seldom do you realize what extraordinary powers it gives you. You use it daily for a dozen different purposes. For friendly chats. For business calls. To save steps, time and trouble. To be many places, do many things, visit many people, without so much as moving from the living room of your home or the desk in your office.

At this very moment, somewhere, your voice would be the most welcome music in the world. Some one would find happiness in knowing where you are and how you are. Some one would say gratefully, sincerely—"I was wishing you'd call."

From among more than seventeen million telephones in this country, the very one you want will be connected quickly and efficiently with the telephone in your home or office.

Your telephone is the modern miracle which permits you to range where you will—talk with whom you will. It is yours to use at any hour of the day or night.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

THE BATTLE OF THE ALCHEMISTS

(*Continued from page 169*)

happened to strike head-on some other particle, such as a proton or an electron, it could deliver momentum to that particle by impact. If such a neutron particle should exist, it would not only be of the utmost interest as a new "building block" of atomic structure, but it would also be a most interesting tool, for it alone of all known particles could penetrate unopposed the sacred structure of nuclei and perhaps knock out a keystone or foundation stone of their structure, causing their collapse. But the neutron would be a most unmanageable tool since, having no electric charge, we could not speed it up or control it by an electric field, as we do electrons, protons, and other ions. We would have to take it as we get it and simply watch to see what it does.

Well, Chadwick discovered this neutron and found that it consisted of one electron and one proton. It is like a hydrogen atom whose orbital or valence electron has been completely captured by the proton nucleus — a hydrogen atom shrunk down to almost nothing. For the preceding four years Bothe and his German colleagues had been playing with neutrons but did not know it, considering them to be photons, i.e., radiations of wavelength even shorter than the gamma rays of radium. Chadwick showed that, if the law of conservation of energy is true, they cannot be photons, and that their action on other atoms like nitrogen or argon is exactly what would be expected if they are neutral material particles of mass 1, i.e., neutrons. When these neutrons bump into nitrogen, argon, and other atoms, they knock them forward by just the amounts that would be calculated from the laws of impact of balls of mass 1 against balls of mass 14, 40, etc.

This is how the neutron was produced. The Kelly Hospital in Baltimore gave Chadwick a lot of old radium emanation tubes which had lost their activity for therapeutic purposes, but which contained the radioactive residues. From these tubes Chadwick extracted polonium, an element which ejects alpha particles of extremely high speed. This polonium was spread over a small plate, which was placed about 2 cm. away from a plate of beryllium, so that the beryllium was subjected to bombardment by the fast alpha particles from the polonium. It was then found that the beryllium emitted rays of a tremendously penetrating nature, which had the power of ionizing any gas through which they passed and of knocking forward those atomic nuclei which they happened to hit. All this was studied by means of ionization devices known as "Geiger ion counters," or by scintillations produced on fluorescent screens. These rays are the neutrons.

Written as a chemical equation, the process is

$$Be(9)+He(4)\rightarrow C(12)+n(1) \qquad (1)$$

Similarly boron behaves like beryllium in giving off neutrons according to

$$B(11)+He(4)\rightarrow N(14)+n(1) \qquad (2)$$

Here the alpha particle is, of course, a helium nucleus of mass 4, and the products of transmutation are carbon, nitrogen and neutrons.

One striking feature of this transmutation is that the products are heavier atoms than the original atoms. This is a process of *atom building*, and not atom disintegration as in the previously known cases of transmutation, radioactivity and Rutherford's artificially produced nuclear disintegration. It is highly important to know that atoms may be built up as well as broken down.

The third and last success of the modern alchemists, to date, was the transmutation of lithium when bombarded by swift protons by Cockcroft and Walton about six months ago. Here the reaction is

$$Li(7)+H(1)\rightarrow 2\ He(4) \qquad (3)$$

This is peculiarly interesting for several reasons. In the first place it is the first instance of transmutation produced by a particle whose speed had been produced by laboratory methods. In the previous cases the bombarding projectiles were alpha particles whose speeds were fixed beyond man's control by the inherent nature of the radioactive process, — except that man could slow them down as desired by interposing absorbing screens in their path. In the present case, however, protons produced by ionization of hydrogen and speeded up by applied voltages up to 600,000 volts were used as the bombarding agents.

In the second place, such a source of bombarding particles may be made ever so much more powerful than the previous sources of alpha particles, for currents of microamperes or even milliamperes of protons may be used instead of the tiny natural currents of alpha particles which, from the high speed sources like polonium, come out at the rates of only a few thousand or hundred thousand particles per second. Thus we may hope to carry on these transmutation processes on a chemical rather than an atomic scale.

In the third place, the proton has only half the charge of an alpha particle and therefore suffers only half the repulsive force as it approaches an atomic nucleus. For this reason we can hope to shoot protons much farther into nuclei than alpha particles can penetrate. Protons thus have in a certain measure the advantage of neutrons, which are not repelled at all, and the great advantage of their capability of use at controllable speeds and quantities.

The final interest to me, personally, in this type of transmutation, is the fact that it was the first of a group of transmutations predicted by Dr. Robert J. Van de Graaff in a report which he made to me about three years ago, and on the basis of which he sought further facilities for developing the high voltage generator on which he was then experimenting. He not only predicted the transmutation, but also the resultant energy liberation of sixteen million volts. He did not predict, for there was no basis for calculating it, how speedy the protons would have to be to effect this transmutation, and I think everyone was surprised to learn that Cockcroft and Walton detected it with proton energies as small as 125,000 volts. At 250,000 volts about one atomic transmutation was found for every thousand million protons which were shot into the lithium. At higher proton velocities the number of transmutations increased. In every case, however, the helium nuclei which were produced had about eight million volts energy apiece, or sixteen million (*Continued on page 188*)

THE BATTLE OF THE ALCHEMISTS

(*Continued from page 187*)

for the pair. It was as if the proton, on entering the lithium nucleus, combined with it to produce two helium nuclei with repulsive forces between them so great that they flew apart with this tremendous sixteen-million-volt energy.

How was Van de Graaff able to predict this energy? How in fact can all the energies in atomic transformations be predicted — for they can be predicted in radioactive processes and in the other cases such as described in equations 1, 2 and 3? The answer to this question lies in an equation, the product of Einstein's genius, perhaps the most important aspect of his whole theory of relativity. Contrary to the much publicized statement that only twelve people in the world could understand his theory of relativity, this part of the theory is very simple and I think that readers can understand it, even though they do not understand the argument through which the conclusion was reached. The equation is, simply,

$$E = M\ c^2 \qquad (4)$$

or, Energy = Mass $\times$ (velocity of light)^2

or, ergs = grams $\times\ 9(10)^{20}$

Being interpreted, this simply means that mass and energy are interconvertible and that if mass disappears, energy takes its place in accordance with this equation. In more familiar terms, $2.13(10)^{13}$ calories of energy are liberated for every gram of matter which vanishes. In still more common language, the annihilation of one pound of matter would create enough energy to heat one hundred million tons of water from freezing to boiling temperatures. Such are the stores of atomic energy. Let us see how this works in reference to the preceding case of transmutation.

A certain isotope of lithium has atomic weight 7.008 and a proton has atomic weight 1.0072. Their sum is 8.0152. This splits up into two helium nuclei each of mass 4.00. Thus the product nuclei have mass 0.0152 less than the original combining nuclei. This lost mass is converted into energy according to equation (4). To calculate the energy, we first change 0.0152 from chemical units of atomic weight into grams, which gives a loss of $2.88(10)^{-26}$ gm. for every individual transmutation process. According to equation (4) this is equivalent to the liberation of $25.9(10)^{-6}$ ergs. This is the amount of energy which would be acquired by an electron in moving through a potential difference of 16,300,000 volts, which is what we mean by sixteen million volts energy.

Thus, by considering various atomic weights in connection with Einstein's equation, we gain a clue as to which atoms may be expected to be relatively easily transmuted, and what the resultant energy will be.

THIS brings me to the final stage of the discussion. With these promising beginnings, just recently achieved after centuries of effort, the alchemist takes renewed hope and enthusiasm in his quest. He now has some knowledge of how to plan his attack on the atom. He has at least two proven weapons, or rather missiles to hurl at atoms, viz., alpha particles from radioactive sources and ions, such as protons, which are given tre-

mendous speeds with high voltages. He will continue to batter away at the atoms with both of these. Of the two, the high voltage ion source is the most intriguing on account of the almost unlimited possibilities of high speeds, through the development of high voltage generators, and of high intensities through the development of potent sources of protons or other types of ions.

It is this feature which gives particular interest to the various new types of high voltage generators which are now being developed in various laboratories. Most promising are those of Lawrence at the University of California and of Van de Graaff at Princeton and the Massachusetts Institute of Technology.

Lawrence does not actually use or develop a very high voltage, but he uses a moderate voltage to give a succession of pushes to the ions until they get to going with speeds equivalent to that given by nearly five million volts, and which may well reach a speed equivalent to 25 five million volts with apparatus under construction. Without going into technical details, the idea may be conveyed by likening the operation to a child in a swing. By properly synchronizing the pushes, the child may be made to swing very high, even though each individual push would lift him only a short distance. Similarly, a voltage of 10,000 volts, applied 100 times in succession to an ion traveling around in a circle under the influence of a magnetic field, will give it the same final energy as if 1,000,000 volts had been applied once.

Van de Graaff has gone back to electrostatic principles and developed a d.c. generator in which electricity at low voltage is sprayed onto a rapidly moving insulating belt which carries it up into a spherical terminal on which it is deposited. The charge and potential of the terminal thus rise up to the point at which further increase is limited by the breakdown of the surrounding insulation. The voltage limitation is therefore that inherently determined by the geometry of the electrodes and the character of the surrounding insulating medium, while the current is limited to the rate at which electric charge is transported by the belts. After successful operation to 80,000 volts of a small generator made of tin cans, sealing wax, and a silk ribbon, a larger generator was built to deliver 30 microamperes at 1,500,000 volts. It was successful, as have also been similar and modified generators built during the past year in several laboratories.

The most ambitious of these generators is one designed to deliver 30 or 40 kilowatts at voltages of at least 10,000,000. This is nearing completion in the M.I.T. Experiment Station on the estate of Col. E. H. R. Green at Round Hill, Mass. The terminals are 15-ft. polished aluminum spheres, mounted on 30-ft. textolite insulating cylinders inside of which run the belts which convey the charge to the spheres. Each sphere is a laboratory room, within which the experimenter can assemble and operate the apparatus which bridges the gap between the positively and negatively charged spheres.

Although this Round Hill outfit is quite spectacular, it is probable that the most important developments of this apparatus will be not in the open air but in some container filled with a medium of superior electrical breakdown strength. The voltage increases directly and the power output directly (*Concluded on page 190*)

THE BATTLE OF THE ALCHEMISTS

(*Concluded from page 189*)

as the square of this breakdown strength. Two such modifications have already been successfully operated in small models, one operating in the best attainable vacuum and the other in gas at about 30 atmospheres pressure.

This is the story of the Battle of the Alchemists to date. They have matched their skill, strength and all the resources of science against the dogged integrity of the atom for many centuries. Within the last ten years, but mostly within the last two years, it has begun to look as if the atom may succumb all along the battle front, even as it has already surrendered three strategic outposts. The field is open, and relatively so little explored that we cannot predict what will be discovered. But we should not be surprised if the next generation should uncover the most exciting and far-reaching developments in the whole history of science. Meanwhile Rutherford, Chadwick, Cockcroft and Walton, Lawrence, Van de Graaff, Bothe, and many others continue the work. They are the modern alchemists, direct descendants of the alchemists of the Middle Ages, and tracing their ancestry back to Hermes and the fallen angels.

PLANE TRAILS OVER LABRADOR

(*Continued from page 180*)

As they reckon travel this meant about one hundred and forty miles. There were some dozen odd Indians at the settlement and two of them were induced to get into the plane and fly in after the body. We took off and with the Indians acting as guides followed a very erratic winding course inland. I could see that they were guiding me as they would travel themselves — by their own canoe trails and portages — but as neither of them had flown before I felt quite sure they would shortly become lost, and consequently I kept jotting down our compass courses so that I could find my way out. As we went along, however, they became surer of themselves and after almost two hours' flying motioned me to land on a small lake. We landed and the Indians got out and walked in a straight line to the body. How they found their way in there was astounding from my point of view. On the way out to the coast it was my turn to amaze them by simply flying a straight compass course which I obtained from an average of our courses in. Once off their own trails the Indians were completely lost and did not know where they were until we reached the coast. Incidently we brought the body out with us, buried it, and subsequently positively identified it as one of the explorers. In all probability he had died of privation.

One other event of considerable interest happened this past summer. In the southern part of Labrador, some three hundred miles from the Atlantic coast and about nine hundred miles northeast of Quebec is an enormous waterfall. Over three hundred feet high, it is considered one of the wonders of this continent. Not many people have seen it because it is so inaccessible, but with an airplane it is simply a (*Concluded on page 192*)

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PLANE TRAILS OVER LABRADOR

(*Concluded from page 190*)

few hours away. We flew in there in 1931 to take the first air photographs of the falls and we went back again this year to get some moving pictures thereof. We had finished our photography and were just leaving when a heavy black smoke appeared on the shore of a lake about ten miles away. Flying over to it disclosed a seaplane on the beach and three men standing by waving frantically. An American had chartered the plane at Quebec, and with a crew of two Canadians, had flown to this spot by means of an elaborate system of laying down their own gasoline dumps. The American was a prospector, I believe, and a lucky one too, although he never would admit it. When they arrived at their destination they landed and discharged 600 pounds of food and supplies on the lake shore. The prospector was to stay here alone with these supplies through the winter and the plane was to return for him the following summer. For the purpose of relocating the spot it was decided to take a few air pictures of it to be developed later in Quebec. All three men were in the plane on this short photographic trip when suddenly the engine broke a valve which went through a piston top and the motor quit. They landed in the lake safely but several miles from the food cache. When we came along they had been there ten days with no food, other than what berries they could find, and were in a pretty reduced condition. Unable to find their food, because they could not orient themselves, they were simply waiting for a relief plane that they hoped might come to them. Their pilot was taken up in our plane and from the air he picked up the cache almost instantly.

It is generally believed by various interests in Newfoundland and in Montreal that a mineralized area of great size has been found in this Grand Falls district. The highest part of the Labrador plateau is here with rivers leaving this very place in four directions. Geologically, it is unlike the rest of the country and at least one large grant has already been given out to American interests. When this gold rush develops, as it may very soon, it is a certainty that air transport will be called on to do its share. When people, supplies, and even mining machinery can be easily flown to the region in three hours from the nearest town, and the trip via canoe takes over a month, who wants to paddle?

TREND OF AFFAIRS

(*Continued from page 183*)

hunt has been closing in; several of the vitamins have been prepared and one of them has been fully identified.

Vitamin A, which occurs in milk, has been recognized since about 1920, as related to the carotenoids, which are the fat-soluble red and yellow substances found in carrots, tomatoes, red cabbage, and other vegetables. A yellow hydrocarbon, carotene, was isolated from carrots and was found to be effective, when dissolved in fat, as a promoter of growth in animals depleted of vitamin A. But carotene is not the vitamin, for it shows only two absorption maxima in the ultraviolet region of the spectrum while the vitamin (*Continued on page 194*)

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TREND OF AFFAIRS

(*Concluded from page 192*)

shows three. It may be that more than one substance can function as the vitamin, and the hypothesis is supported by the fact that preparations from different sources differ in stability, color, and potency. In a series of brilliant researches during the last three years, Karrer and his co-workers have proved the structure of carotene and have reached the conclusion that the vitamin, molecular weight 333, is produced from carotene, molecular weight 536, by a splitting process, perhaps an oxidation, and that it owes its vitamin characteristics to certain peculiarities of its structure; namely, to the ionone ring and to a special conjugate system.

Carotene is converted into vitamin A within the animal body. Olcott and McCann within the past year have converted carotene into the vitamin by treating it in glass vessels with the extract of the livers of rats depleted of vitamin A. They found further that the liver extract lost its power to accomplish the conversion if it had been previously heated, and concluded that the conversion in the animal body occurs through the agency of an enzyme which is secreted by the liver.

Vitamin B occurs in rice polishings and in brewer's yeast. During the past year Windaus has isolated it from yeast in the crystalline condition and has found that it contains nitrogen and sulfur as well as carbon, hydrogen, and oxygen. It appears to be the only vitamin which contains sulfur.

The recent researches of Ottar Rygh, described in The Review last July, have shown that vitamin C is the ortho-diphenol of narcotine. It may be prepared synthetically.

Vitamin D, like vitamin A, is found in the unsaponifiable residues of natural fats. In 1926 its "provitamin" (the substance from which it is formed) was identified simultaneously by Rosenheim and Webster in England, and by Windaus in Germany as ergosterol, and highly active products were prepared from that substance. In 1928 Windaus and Linsert showed that ergosterol is isomerized by ultraviolet irradiation, and concluded that the vitamin was probably an isomer of regosterol; that is, a substance containing the same atoms as ergosterol, the atoms now linked in a different manner.

During the years 1931 and 1932, five different crystalline irradiation products of ergosterol have been prepared by various workers in England, Germany, and the United States. The materials all have a high vitamin potency, but differ somewhat in this respect among themselves as they also differ in their melting points and optical properties. They are, of course, all isomers, or mixtures of isomers, of ergosterol. Windaus believes that the essential chemical characteristics of the ergosterol molecule are unaffected by irradiation and supposes that "a steric or spatial rearrangement" occurs "whereby the spatial size of the molecule is increased." He considers that the investigation of vitamin D is practically complete.

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M. I. T. NEWS BULLETIN

PREPARED BY JOHN J. ROWLANDS, DIRECTOR, INSTITUTE NEWS SERVICE

Aerological Research

Expansion of the program of aërological research, undertaken by the Institute to gain new knowledge of the atmosphere for several miles above the earth, is assured by the recent financial grant from the Rockefeller Foundation.

The studies were started a year ago, one of the first objectives being to gather information which, it is hoped, will aid in developing more accurate methods of forecasting local weather conditions. Plans for extending this research include studies of the distribution of the pollen of plants, bacteria, and insect life in the air currents above the earth. The generous assistance of the Rockefeller Foundation now makes it possible to advance these investigations. In addition to appropriations by the Institute, the Blue Hill Observatory of Harvard University this autumn assisted with a special grant which made it possible to carry on the research without interruption.

In this investigation, daily weather observations from the ground to a height of approximately four miles above New England have been made by members of the Division of Meteorology at Technology in a specially equipped airplane. These flights make it possible to secure daily records of temperature, barometric pressure, and humidity, as well as observations on fog, haze, ice formation, and clouds. Preliminary experiments indicate that studies of the bacteria content of the atmosphere, the distribution of pollen and the spores of plant diseases, and insect pests that already have been found in the wind currents high above the earth, may develop important knowledge.

Future of Railroads

In the second Aldred lecture, Ivy L. Lee, noted authority on public relations, discussed "The Outlook for the Railroads." He described the plight of the great rail systems of the country, which are suffering not only from the effects of present economic conditions but from the rapidly growing competition of the automobile, truck, and air line.

In emphasizing the seriousness of the situation, Mr. Lee said that government control of the country's railways may be necessary unless some means are found to make it possible for the carriers to operate at a profit. Few railroads, he added, are earning enough to pay operating expenses.

A Science Exhibit

Scientific apparatus representing important research developments at the Institute was exhibited at the meeting of the American Association for the Advancement of Science at Atlantic City on December 28, 29, and 30.

While the display of scientific apparatus by manufacturers has long been a feature of the meetings, the exhibit from various colleges and technical institutions was a recent development.

Included in the Technology exhibit was a model of the new portable electrostatic generator designed by Dr. Robert J. Van de Graaff, the instruments used by Dr. Ralph D. Bennett in the survey of cosmic rays, and Professor Francis W. Sears' apparatus for light scattering by supersonic waves.

Other devices shown were the mercury-arc stroboscope developed by Dr. Harold E. Edgerton '27, Professor John W. M. Bunker's electrodialysis apparatus, the photoelectric bacteria counter of Dr. Marshall W. Jennison, and a device designed by Professor Frederick G. Keyes, Head of the Department of Chemistry, for measuring absolute pressures from a small fraction of an atmosphere to 1,200 atmospheres.

Part of the exhibit was devoted to photographs of various research developments at the Institute, including the differential analyzer designed by Dean Vannevar Bush; the new electrical circuit for high-speed photography developed by Professor Edgerton and Kenneth J. Germeshausen; the meteorological studies by airplane; and progress in the erection of Dr. Van de Graaff's large generator at Round Hill, Mass.

The exhibit was in charge of Dr. Bennett, Dr. Edgerton, and Dr. Ervin H. Bramhall '27.

A scientific paper on the electrostatic generator designed by Dr. Van de Graaff was presented jointly by the latter, President Compton, and Dr. Lester C. Van Atta at a session of the American Physical Society, which met as a section of the Association. Dr. Louis B. Slichter presented a paper dealing with geological problems. Professor Hurd C. Willett and Dr. Karl O. Lange, of the Division of Meteorology, attended the meeting, the latter delivering an address on the progress of aërological research at the Institute.

During the session, Professor Dugald C. Jackson, Head of the Department of Electrical Engineering, was elected to membership in the council of the American Association for the Advancement of Science. He delivered an address before members of the organization on "Machinery and Unemployment."

Other members of the staff of Technology who attended the various sessions included Dr. Harry M. Goodwin '90, Dean of the Graduate School, and Professor Arthur L. Townsend '13 of the Department of Mechanical Engineering. The Department of Mathematics was represented by Dr. Henry B. Phillips, Dr. Jesse Douglas, Dr. Philip Franklin, and Dr. Eberhard Hopf.

The Atlantic City gathering had more than usual significance for scientists of Boston, because of the fact that the Association will hold its meeting here next winter. A local committee is already at work on plans for this gathering, which will bring together scientists from all over the United States. President A. Lawrence Lowell of Harvard University is Honorary Chairman, and President Compton, Honorary Vice-Chairman of this committee. Dean Samuel C. Prescott '94 of the School of Science at Technology is Chairman of the committee on arrangements.

Awarded

As third Rhodes scholar from the Institute, Ivan A. Getting '33, Edison prize winner and captain of Technology's gymnasium team, will go to Oxford University next fall to continue his studies in theoretical physics.

By the terms of the award, Getting is entitled to two years of study at Oxford, with the privilege of a third year if his record warrants it.

Since entering the Institute in 1929 as an Edison scholar, Getting has maintained an exceptionally high scholastic average. Last March he was elected to the captaincy of the gymnasium team, and at the same time received his T.

The son of Milan Getting, former Czechoslovakian consul at Pittsburgh, Ivan prepared for Technology at the Schenley High School in that city, where he took an active part in athletics and served as President of his senior class.

At present he is carrying on research in the field of electronics.

Honored

For outstanding contributions to the proceedings of the Society of Naval Architects and Marine Engineers, Professor William Hovgaard of the Department of Naval Architecture and Marine Engineering was recently elected to life membership in that organization.

Technology's Seismograph

The new seismograph station of the Institute, the most easterly on the North American continent, is now in operation in an isolated section of northeastern Maine. The country in which the new seismographs are keeping their vigil has long been one of the largest eastern "blind spots" in earthquake studies.

Technology's station, which has been in preparation for several years, represents the most advanced knowledge in the design of instruments for recording earthquakes. Up to the present, the nearest seismograph stations have been located at Cambridge, Mass., and Ottawa, Canada.

The isolation of the new station, with its freedom from artificial disturbances found in and near cities, is considered of great importance, and it was because of this fact that the summer engineering camp of the Department of Civil and Sanitary Engineering near Machias, Maine, was chosen as the location. Because it stands on a firm foundation of ancient volcanic rock, in a zone of many geological faults, observations of this station are expected to be of unusual interest to seismologists and geologists.

The records of Technology's seismographs are sent directly to the headquarters of the United States Coast and Geodetic Survey in Washington, where similar records coming from widely separated stations make it possible to determine accurately the origin of the earthquakes. The new station is in charge of Professor George L. Hosmer'97, who makes his headquarters at Camp Technology during the summer.

The building in which the instruments are housed is constructed of concrete with walls nine inches thick. The interior is lined with two layers of insulating material separated from the wall and from each other by air spaces. The concrete pier on which the instruments are installed has its foundation on an outcrop of volcanic rock which underlies this section of Maine near the shores of the Bay of Fundy.

The seismographs, which were designed and built by Dr. Frank Wenner of the United States Bureau of Standards, consist of two separate units, one for recording east and west movements of the earth, and the other to detect waves of north and south direction. The slightest earth tremor registered by these delicate instruments sets up an electric current, which is transmitted by a special cable to the recording instruments in a building a thousand feet from the seismograph house.

The recording room, located in the basement of the home of E. O. Dennison, resident superintendent of Camp Technology, is light-proof, and in addition to the instruments for receiving earthquake data, is equipped for developing the photographic paper on which the records are registered.

The electric currents generated when the seismographs register an earthquake operate an extremely sensitive galvanometer, which by means of a tiny mirror writes the message of a distant earthquake with a pencil point of light. The record is registered on a revolving drum covered with specially prepared photographic paper. The drum is driven by an accurate clock mechanism, and the exact instant of the beginning and ending of any earth disturbance is automatically noted on the record.

One-Day Semester on Economics

Vital problems facing business and industry during the coming year were discussed in a unique "one-day semester" course for former students of the Department of Business and Engineering Administration at the Institute on January 2.

In a program of authoritative addresses, members of the department, in coöperation with leaders in the Department of Economics, discussed national and international conditions, including unemployment, monetary inflation, organized labor, marketing under low price levels, and the legal aspects of the business situation.

This New Year's conference was organized by Professor Erwin H. Schell'12, Head of the Department of Business and Engineering Administration. Among those who spoke were Professor Davis R. Dewey, Head of the Department of Economics, Professors Carroll W. Doten, Ralph E. Freeman, and Brainerd A. Thresher'20, all of the same department; and Professors Robert F. Elder, Albert A. Schaefer, and Professor Schell of the Business and Engineering Administration Department.

To this conference, which was held in Walker Memorial from 10 A.M. to 4:15 P.M., came more than 100 former students from New England and New York. The conference was the second of its kind at Technology, the first having been held in January, 1932.

Phi Delta Theta

The admission of Psi Delta, local Technology organization, as a chapter of the national social fraternity of Phi Delta Theta was recently announced following a unanimous vote of approval of the Alpha Province and the Phi Delta Theta Alumni Club at the Institute.

Phi Delta Theta fraternity was founded at Miami University, Oxford, Ohio, in 1848. In 1930 it possessed 97 active chapters, with a total membership of nearly 40,000. Psi Delta was organized at Technology in 1922.

Ellen H. Richards Memorial Day

Tribute to the memory of a great woman scientist by one of her former pupils was paid in an address by Dr. Alice G. Bryant'86 at the Ellen H. Richards Memorial Day meeting of the Technology Women's Association on December 2.

The dramatic career of Ellen Swallow, the intrepid young Vassar graduate who, as the first woman to enter the Institute, set a new precedent in the scientific education of women, was retold by Dr. Bryant from the standpoint of one who knew her well.

Born in 1842 and graduated from Vassar in 1870, Miss Swallow served as a member of the faculty at the Institute for 25 years. In 1875 she married Professor Robert H. Richards, who was then Head of the Department of Mining and Metallurgy.

An ardent student of chemistry, and founder of the science of home economics, Mrs. Richards was an authority in many other fields of knowledge. She served as a mining prospector and consulting engineer, an inspector of sewage disposal and of plant management, a water analyst, industrial expert, and sanitary adviser in schools, factories, asylums, and prisons.

According to Dr. Bryant, Mrs. Richards was one of the pioneers in recognizing the importance of pure food and its correct preparation, uncontaminated drinking water, proper sewage disposal, and healthful heating and ventilating systems.

Mrs. Richards' varied activities and interests led her to help found or act as moving spirit of many organizations. Among others, she was instrumental in the work of the American Home Economics Association, the Woman's Chemical Laboratory at Technology, the Rumford Kitchen at the World's Fair, the Hyannis Marine Laboratory, the Normal School of Household Arts, the Woman's Education Association, and the Lake Placid Club.

In honor of her work as adviser to the founders of the School of Household Science and Arts of Pratt Institute, students of that school on the anniversary of Mrs. Richards' birth, December 6, held a memorial service at which tableaux were given depicting highlights of her notable career.

Causes of the Depression

Declaring that "this futile and foolish" depression could have been prevented if the knowledge already achieved by scientists and engineers had been applied, Mr. Edward A. Filene, merchant and economist, in the first of the season's Aldred lectures blamed "ox-age" thinking for the present economic situation. He spoke to faculty members, juniors, and seniors on "The Engineering Mind and the Second Industrial Revolution."

Mr. Filene attributed the lack of coordination between our systems of production, distribution, and finance to a traditional, rather than a scientific, fact-finding approach to problems.

Said Mr. Filene in part: "You coming engineers have the key to world abundance, to world leisure, to the lifting of all human life above the sordid struggle of existence and into the spiritual adventures which lie beyond."

NEWS FROM THE CLUBS AND CLASSES

CLUB NOTES

Technology Club of Albany

The resumption of activities by the Club was marked by the presence of Dr. Compton as our guest on December 8. Arriving in Albany in mid-afternoon, Dr. Compton inspected the new Albany-Rensselaer Bridge and Port of Albany Development with C. H. Wood '91, President of the Club. An informal meeting with the leading educators of Albany followed at the University Club.

At 6:45 p.m. a dinner meeting was held in the main dining room of the University Club, the attendance being the largest in the history of the Club. Dr. Compton gave an interesting discourse on the new organization and financial policies at M. I. T. The new admission plan, balancing the budget, the ever-increasing cost of educating the student, the distribution of undergraduates in the various courses, and the student loan plan were among the items stressed.

The following members were present: C. H. Anderson '27, W. E. Barton '08, R. D. Bates '14, H. Braun '32, W. A. Canaday '12, H. M. Chapman '02, A. E. Cluett '96, J. G. Fairfield '16, J. H. Finley '25, R. Forster, A. P. Gerry '05, C. C. Gordon, L. S. Greenleaf '94, L. Grossman '24, H. F. Hedberg '20, C. N. Henshaw, C. E. Lanyon '24, E. H. Linton, H. J. MacMillan '24, L. V. Phelps '26, J. Ramsey '25, A. M. Ricciardelli '30, B. R. Rickard '99, E. H. Sargent '07, C. E. Smart '05, E. E. Snyder '14, R. Suter '00, F. N. Thomson, R. E. Walsh '28, C. T. White '17, C. H. Wood '91. — Redmond E. Walsh, Jr., '28, *Secretary*, New York Power and Light Corp., Albany, N. Y.

M. I. T. Club of Northern California

An extremely pleasant gathering was held at the home of Captain J. J. Thomas '07, on Tuesday, November 22. Approximately 30 members, their wives, and friends were on hand and were treated to a most interesting astronomical evening. Two telescopes were available for use, one a three-inch refractor, and one a ten-inch reflector, both built by Captain Thomas. In addition we heard an illustrated lecture by Mr. Adams, Secretary of the Astronomical Society of the Pacific, and witnessed the first public showing of the Inverness Picnic movies.

The Secretary wishes to call particular attention to the list of unemployed Technology graduates which is sent with each mailing, with the request that all those who are in a position to do so extend some help to these men in getting located. Complete information is kept on file by our organization, and the service is entirely free of all expense. Any men who are seeking employment at present in this territory can be listed upon supplying us with their experience records.

The regular Tuesday luncheons, held at the Engineers Club, Pine and Sansome Streets, San Francisco, are well attended. All Technology men, whether permanently located here, or transient, are most cordially invited to drop in any Tuesday noon, where a special table is reserved and where they will be assured of an interesting gathering. — Rolfe A. Folsom '18, *Secretary*, 150 Hooper Street, San Francisco, Calif.

The Technology Club of Rochester

The regular meeting of the Club was held December 15 at the University Club of Rochester. The date at any rate was regular, but otherwise the meeting was anything but stereotyped. In the first place, Professor Ryan, Head of the Chemical Engineering Department, was present to give us a first-hand, illustrated talk regarding affairs at M. I. T. In the next place, members arrived promptly for the discussion preceding the dinner, and there certainly was nothing cut and dried about this portion of the activities. And when it came time to partake of stable nourishment, it was very evident some at least were literally double. The 30 who had signified their intention of being present were actually 40.

We learned something of the coöperative courses and of possible future plans for a Research Laboratory of Applied Science, what type of research should be undertaken, and costs to be met. The financial condition of the Institute was illustrated and the relative soundness of the Institute's investments was pointed out. The new plan of admission to the Institute was described and it was noted the major Rochester high schools were on the "accredited list." And having been admitted and looking forward to graduation, some idea of the effort made by the Institute, particularly at this time, to place one usefully in industry was brought to our attention.

Mr. Ancona gave a summary of the successes made by the several holders of the freshman scholarship annually awarded by the Club. All the applicants have done well. — It was planned to make the next meeting of the club a formal supper dance at the University Club on January 14. Following this, there is planned a meeting on February 7 at which Dr. Compton will, it is hoped, be present. The December meeting was a great success and this was due to Professor Ryan, whose special effort to be there is greatly appreciated. — Laurence T. Tufts '29, *Secretary*, Building 26, Kodak Park, Rochester, N. Y.

The M. I. T. Club of Western Pennsylvania

The regular December Dinner Meeting of the Club was held on December 8 at the University Club of Pittsburgh. Due to the present interest in public utility topics, it was thought that the members would be interested in hearing a discussion of this subject by a member of the industry.

Mr. Frank R. Phillips, President of the Philadelphia Company, consented to be our guest speaker for the evening. The Philadelphia Company Group, of which Mr. Phillips is the head, is the holding and management company for the electric, gas, and street railways utilities in the Pittsburgh district.

Mr. Phillips' address was based upon his wide and varied experience in utility work, including his connections with the Cleveland City Railways Company, the Cincinnati, Newport and Covington Light and Traction Company, and the United Light and Traction Company, Michigan. Mr. Phillips' discussion dealt personally with the Philadelphia Company Group, where since 1910 he has held various executive positions with the Pittsburgh Railways Company, the Duquesne Light Company, and the Equitable Gas Company before assuming his present position.

Mr. Phillips gave us a most thorough discussion of utility problems from the standpoint of the utilities themselves. The references to and the discussion of the Pittsburgh Companies made the talk of particular interest to the Club members. — C. M. Boardman '25, *Assistant Secretary*, Duquesne Light Company, Pittsburgh, Pa.

CLASS NOTES

1868

The Class of '68 has just lost one of its beloved members by death at a ripe old age. Joseph Warren Revere died at the age of 84, leaving three daughters and a son, and two brothers and a sister. This death leaves only two surviving members in the Class of '68. They are: Robert Hallowell Richards, Professor of Mining and Engineering, M. I. T., retired, Emeritus, and Daniel Merrick Wheeler, of Pittsfield, Mass., chief engineer of the Berkshire Street Railway Co.

Any account that I write in regard to Joe Revere must be full of my warm affection for him, and of my thankfulness to him for the great help that he gave me in the early 'Seventies, when I was wearing myself out struggling to make the new Mining Course for the Institute take shape.

In 1870 Professor Runkle, who had just been made President of the Institute, went on the new transcontinental rail-

Technology men seeking entertainment will find an announcement of interest on page 191 of the Front Section.

1868 Continued

road to San Francisco, and engaged the help of two large firms who manufactured milling machinery either to give or furnish at a low figure milling machinery for the new mining laboratory, and in 1871, when President Runkle took the first great mining expedition for Institute students, he asked Professor Ordway to build during the summer a set of assaying furnaces for the fire assay of gold, silver, copper, and lead ores, and also a set of furnaces of a larger size in which simple metallurgical processes could be conducted on a large enough scale so that the labor involved by the student, should not be too great a tax on his strength.

One day, in 1873, Joe Revere came in in his bright, jolly way and said to me, "Now let's smelt a batch of copper ore in our little blast furnace" (the crucible was 14 inches wide, 18 inches deep, and the shaft for carrying its charge was five feet high, with one tuyere at the back). Joe was an expert smelter, and it was a wonderful privilege for me to have him come in and put me through the smelting operation — through all the different necessary steps of charging coke, ore, and flux at the top of the furnace, and tapping out molten matte and slag at the tap hole at the bottom of the furnace. It should here be said that we had two iron pots. The first, receiving the molten slag and matte from the furnace and overflowing by a side spout, sent the clean slag over into the second iron pot. This operation of tapping is repeated at 10 or 15 minute intervals all through the three- or four-hour period of the run, the two pots for each successive tap, replaced by two more empty pots, and the full pots were wheeled off to the side of the room where they would cool off.

On the next day, when the matte and slag had all cooled off, a slight tap of the hammer separated perfectly the matte and the slag from the first pots, the matte being much heavier formed as a cake at the bottom of the pot, and the slag, being lighter, formed a cake at the top of the pot. The second pot only contained slag.

Owing to Joe's skill and experience, the smelting operation was a perfect success, and the lesson there taught to me was repeated every year with successive classes as long as I taught school, and it has been continued by my successor, Professor Hayward, ever since. — One year, when the Department was moving over into a new building, Hayward had to omit the smelting operation from the course, and he found that the students grasped the subject of metallurgy taught in the lectures much more poorly than when the furnace was used.

Working at the Metallurgical Laboratory and the Ore Dressing Laboratory, where I had not only to find the ores, get them shipped to Boston, decide upon the amount of ore to be treated, teach myself the various operations of smelting and ore-dressing, designing and putting in ore-dressing machinery, teaching my students how to run the furnaces and the ore-dressing machines, I was so overworked that it must have been painful to my friends to see me.

One day, Joe came in and said to me: "Come out and go suckering with me." He took me out to his family's wonderful house in Canton and, giving me a delightful entertainment there, he then took his fish spear and we went out to the rapids below the dam in the little stream, and there we saw a lot of suckers. We immediately proceeded to spear them with the fish spear, having lots of fun and cheering me up from my overwork at the Laboratory and giving me wonderful relaxation. — One summer Joe said to me, "Let us go out West and have a trip together." I met him in San Francisco and we went up to Grass Valley where the great gold mines are, and from there to Virginia City, Nev., which was then just going through that extraordinary bonanza period which has probably never been known before or since in this country. We went down some of the mines and we found there the speculation was going on with such tremendous force that no one in the town escaped. The servant girls in houses were all speculating, getting two or three quotations a day from the stock market. One mine, six months before, had its stock selling at $3.00 a share, and when we were there six months later, that same stock was selling for $1,700 a share. There were other mines doing the same thing.

We went next to Wyoming and at Laramie City we hired saddle horses and rode out to Ute Pass, 30 miles. I had not been on a horse for years and when I got off the horse, I thought my last end had come. I said, "Where's the bed?" I crawled on to the bed and did not move until the next day. Buck told us lots of stories: how he, sitting in the doorway of this little dug-out camp, had seen a grizzly bear coming for him not very far away, and how he had killed the bear and saved himself with the little rifle that he had. The next day Joe and I mounted our horses and after I had ridden a quarter of a mile, my stiffness was all gone and I had forgotten about the terrible feeling I had had the night before.

Joe came in to see me another time and said, "You're fond of taking your classes out to visit mines, why don't you come up to Cape Breton to the Sydney Coal Mines where I am located and make your summer trip there?" This was no sooner suggested than done, and we divided our squad into two groups, and Hofman took one group into the mines, studying the methods of coal mining, and I took the other group, making a coal survey of seven miles long along the Atlantic coast. That survey of mine, when sent up to the Dominion Coal Company, so pleased the company that they put it on file in their office as a standard part of their property. — Incidentally, I can say that when some of my boys went into the Sydney Coal Mine, they had the novel experience of going out through the levels and rooms of the mine until they were two miles under the sea.

Incidentally, too, I can mention this interesting fact. I was making a visit to a possible oil well at Whycogomah and it was important for me to know what the specific gravity of the salt water of the ocean was, because I knew I should have salt water pumped out of the alleged well, and I wanted to know whether it was *bona fide* well salt water or ocean salt water that had leaked in. So when I was on my way there at Mulgrave, I took my specific gravity tube down to the shore of the Straits of Canso, we having had a severe thunder shower the night before, and lo and behold, the ocean water was perfectly fresh. I immediately wondered whether my specific gravity bottle was out, so I drank some of the water and found it was perfectly fresh. I had to go from Mulgrave over to Hawkesbury and I did not get to real constant salt water, as I was dipping it up out of the ocean from the side of the boat, until I was pretty nearly 100 feet away from the shore.

The next thing that occurred between Joe and me in the school line was when I had to be taught how to refine copper. Ordway had put in a little refining furnace and I had not the slightest experience in refining copper, so Joe took me out to Canton and turned me over to his friend and my friend, Will Howard, who was doing important work for the Revere Copper Company, and with Howard I watched the process of refining a great batch of copper from the impure black copper, as it was fed to the furnace with quite a little iron and sulphur in it, through its various stages until it turned up pure, beautiful red, soft ingot copper. We watched all the processes of charging and rabbling to remove the iron and the sulphur until it was nearly ready. Then, it being between two and three o'clock in the morning, I took out of my bag a little lunch that I had brought with me and proceeded to eat that. Well, Howard watched me. He knew perfectly well what would happen and I didn't. I hadn't eaten that lunch but a few minutes when I began to get sleepy, and Howard took me over to his house and gave me a sofa and a shawl to cover me, and my head had not more than touched the pillow before I was sound asleep. Howard turned up about three hours later and tried to waken me. He succeeded in getting my eyes open and I sat there looking at him, not knowing that it was Howard, not knowing that it was daylight, in fact, not knowing anything with my eyes wide open. By and by, my mind began to work and then Howard said to me, "You lost nothing on the refining process by being absent for the three hours, but they are now coming to the period when it is very important that you should be there." Accordingly, I dashed some water on my face and then went out to watch the furnace. The rabbling was all done and the boiling of the sulphur was all finished and all that was left to do was the poling with birch poles, by which the last of the oxygen is taken out of the copper and the copper is ready to be ladled into the ingot molds making the beautiful finished market copper. Then I watched the taking of tiny samples to see that the copper had reached the pure, malleable condition, and I took some samples myself and learned how to ham-

1868 Continued

mer and break them in order to get the silky fracture of the pure copper. This completed the operation and I returned to Technology with one more valuable process that I could teach on a small scale to my boys in the laboratory, thanks to the wonderful help that Joe had given me, and through Joe, my friend, Howard. — ROBERT H. RICHARDS, *Secretary*, 32 Eliot Street, Jamaica Plain, Mass.

1876

At the request of several members of our Class, I have taken over the duties of Class Secretary, which office was made vacant by the death of the only Secretary the Class ever had, John R. Freeman.

Freeman took his office seriously. Among other things he planned to do was to publish a history of the Class on its Twenty-Fifth Anniversary. He put a large amount of time and expense into this project, but never finished it. After he became so tremendously busy with insurance and engineering, there was not much news published regarding the members of the Class, but this was largely due to the fact that the members were scattered over the face of the earth, and it was difficult to get information concerning them.

Now the roll is contracted to a relatively small number. I have written to those whose addresses were known, requesting such information as might be of interest to the few remaining.

From Charles Sawyer there comes a note concerning an interesting incident in the early part of his career. Charles A. Sawyer reports that he is living in Chatham, Mass., with one of his four sons. It is of interest to recall that Sawyer was the first Technology graduate to practice law in Illinois. In those days, before a young lawyer was admitted to the Bar, he was obliged to pass a five-hour oral examination by the full bench of the Illinois Supreme Court. Sawyer's certificate, dated June 17, 1879, is signed by Chief Justice T. Lyle Dickey, a noted jurist of that period. Sawyer's eldest son, Charles A., Jr., is at present a member of the Executive Committee of the Alumni Association. Sawyer wishes to be remembered to all of his classmates.

From Charles R. Fletcher, Los Angeles, Calif., there comes a remembrance of the days of '76, and without any intention of opening the discussion as to what class the honor of selecting the M. I. T. colors should go to, Fletcher's contribution is presented: "In 1876 I was on the M. I. T. 'Colors' Committee, and when two colors were talked of I suggested my favorite ancestral grey of the Douglas Clan of Scotland, my mother's family being the Douglas of 'Tantallon,' North Berwick, Scotland. This color was selected along with the cardinal red as the Tech colors.

"You may be as amused as I was recently when I received the following Scotchman's words about the antiquity of the Douglas clan. They appeared in the *Literary Digest* of November 5: 'A modest Scotchman, in speaking of his family, said: The Douglas family is a verra, verra auld scotch family. The line has rin awa far back into antiquity. We dinna ken hoo far back it rins, but it's a lang, lang way back. The history of the Douglas family is recorded in five volumes. In about the middle of the third volume, in a marginal note, we read, "Aboot this time the worrld was created."'"

Dr. William W. Jacques, 77, died at his summer home at Chester, N. S., on June 24. Dr. Jacques was associated with Dr. Alexander Graham Bell in the invention of the telephone. Dr. Jacques was born in Haverhill, Mass., and received his B.S. degree from Technology, his M.S. degree and Ph.D. from Johns Hopkins, and studied in Berlin, Leipzig, Vienna, and Göttingen. He was a fellow of Johns Hopkins, a lecturer on electrical engineering at M. I. T., consultant for the Bell Telephone Company, and originator of many of the salient inventions and engineering devices that have made long-distance telephony practicable.

He was expert for the anti-submarine division of the British admiralty during the War, and originator of the device by which submarines were detected and located. He had a home at 469 Beacon Street, Boston. — CHARLES T. MAIN, *Secretary*, 201 Devonshire Street, Boston, Mass.

1888

Arrangements are practically completed for the grand celebration of our Forty-Fifth Anniversary and Reunion at Cape Ann, Rockport, Mass., during the second week-end in June. The Reunion Committee (consisting of President Alfred Sawyer, Ned Webster, Billy Keough, Fred Ellis, and the Secretary) has been at work since the middle of November with the idea in view that prompt settlement of the time and place would enable a record-breaking number of '88 men to make their plans far in advance to converge on Boston and Rockport on Friday, June 9, to Monday, June 12.

This long advance notice should enable Steve Child from the Golden Gate of California and Charlie Nutter in the pine forests of Maine, also Teddy Foque from the snow-clad hills of Minnesota, and Ed Quigley in the balmy climate of Alabama to so order their affairs that they will be on hand at the University Club, Boston, at 9:30 a.m. sharp, June 9, with their bathing suits, golf clubs or tennis racquets, cameras, and so on, to take the 40-mile motor trip through Salem and along the famous North Shore Drive to Straitsmouth Inn on Gap Head, Stonehaven, Cape Ann, Rockport. This Inn is on a rocky headland at the tip of the Cape, yet near a bathing beach, boat landings and harbor, with golf and tennis at the Country Club only half a mile away. It contains 38 rooms, 14 with private bath, foyer with large, open fireplace, living room with piano, and dining room with a capacity of 125 persons. The entire house is reserved exclusively for us during the four-day celebration, each man selecting his own individual room immediately on arrival. Like a big, happy family we shall be seated at one long table at each meal, with seats for 40 to 50 or more. The food will be very good, with lobster, clams, and other fresh sea food.

On Saturday noon we shall have our regular "clam bake on the rocks" at Pigeon Cove. Only one bushel of clams has been ordered but more can be dug on short notice. Among the attractions are fishing, boating, horseback riding, and beautiful motor drives in all directions. For the "hikers," within walking distance are Long Beach, Laurel Ledge, Paradise Cliffs, Pigeon Hill, the mysterious ruined village of Dogtown, and the artistic settlement of Annisquam. Drinking water comes from a nearby spring, four lighthouses aid in the illumination, and your wife can get you on the long-distance telephone, if necessary. A group photograph will be taken on the rocks with the Atlantic Ocean and Spain for a background. There will be bathing parties each day in water at a temperature to suit all (if possible). There will be a program of sports and recreations for each day to suit the most fastidious, subject to change, however, to allow ample time to talk over the happy days at Tech and swap Scotch stories. No serious discussions are expected so "pack up your troubles in your old suit case" and dump them off the end of Cape Ann. As an added attraction we hope to pull off a heavyweight boxing exhibition between Ellis and Quigley. This is a tip to Quigley to start training for Ellis is already in "great shape." The hotel rate is so low you will be surprised when you get it in a personal letter from the Secretary early in the spring with other details and more attractions. So make your plans to come for the entire three days although two or even one day would be a whole lot better than not coming at all. Our Fiftieth Reunion is five long years in the future and we do not know what may happen in the meantime.

Russell Robb, son of our classmate, and Miss Katharine Moxley Armstrong, daughter of Mrs. George Allen Armstrong, of Shelbyville and Louisville, Ky., were married January 3 in Kentucky. — Mrs. Mary Fidelia Webster, widow of Frank G. Webster and mother of our classmate, Edwin S. Webster, died at her home, 167 Commonwealth Avenue, Back Bay, on December 15. Mrs. Webster was in her 90th year. There are three surviving children and 12 grandchildren.

Hundreds of friends and co-workers of the late Helena Stuart Dudley, our classmate during freshman year, whose death on September 29 was announced in our December notes, paid tribute to her memory at a special memorial meeting at Denison House, 93 Tyler Street, Boston, on November 20. The speakers included a large number of her associates in social and settlement work during her 45 years of activity in those lines.

Our genial classmate, Frank M. James, from whom we have not heard for the last 24 years, has just come to light at 50 River Street, Haverhill, Mass., and we

1888 Continued

are very glad to replace his name on our active list, which now has 93 names and addresses. — President Alfred, under date of December 18 from his home in the "arctic" town of Concord, Mass., reports: "Doing pretty well for late fall with 15 degrees below zero and nine inches of snow." — BERTRAND R. T. COLLINS, *Secretary*, 25 Bennington Street, Newton, Mass.

1890

We have just learned that the Royal Society of London has awarded the Copley Medal, highest distinction given by England for scientific research, to our classmate, Dr. George E. Hale, of the Mt. Wilson Observatory. The first American to receive it was Benjamin Franklin, to whom it was awarded in 1753 for his "curious experiments and observations on electricity." Among seven other Americans to receive the award was the late Dr. Albert A. Michelson, Pasadena physicist. The present award was for researches in the magnetic fields of the sun. The first magnetic phenomena detected outside the earth were the magnetic fields in sun spots, discovered at the Mt. Wilson Observatory in 1908. Later, with the 150-foot tower telescope on Mt. Wilson, the entire sun was found to be a magnet, with a magnetic field stronger than that of the earth but much weaker than the intense fields in sun spots.

We have just been advised of the death on October 27 of Bowen Bancroft Smith, who was at Technology in our day. His home was at Tuxedo Park, N. Y., and he was a retired architect.

We note from the press, that Pierre S. du Pont carries the largest life insurance of anyone in the country, amounting to seven million dollars. We trust it will be many years before the Insurance Companies are called upon to come across with this amount, and that Pierre will be able to keep up the annual payments for the rest of his life.

We regret to announce the death of our classmate, John O. DeWolf, who passed away suddenly November 17, following an operation. John has been our Class Representative on the Alumni Council for many years and seldom missed a meeting. He was present at the last meeting October 31. John and Mrs. DeWolf have lived for many years at their home 5 Edgehill Road, Winchester, Mass. His office in business was at 45 Bromfield Street, Boston, where his work had been in Mill Engineering. Funeral services were held at the Episcopal Church at Winchester, and nine of our classmates were present.

Dr. Willis R. Whitney, who has been director of the General Electric Company Research Laboratory for 32 years, has retired from active work on account of poor health, and Dr. William D. Coolidge succeeds him. Willis will continue, however, as Vice-President in general charge of research. Willis has received many medals in the past few years, and we trust now that he has decided to take life a little easier, he will have many happy years yet before him.

We have just been advised of the death of Willard L. Bowker, of Walpole, Mass., who passed away September 18. We remember Bowker as being with us our freshman year only.

We have just been advised that Billy Ripley is getting along very well in Holland, and that Mrs. Ripley is with him, but they will probably not return home until Spring. — GEORGE L. GILMORE, *Secretary*, 57 Hancock Street, Lexington, Mass.

1894

A. B. Tenney, who has for many years been administratively connected with the activities of the Charles H. Tenney Company of Boston, is going to take a vacation. We hasten to add that this is not of the kind which many have been obliged to embark on during the past two or three years. This is to be a real vacation, and the culmination of long-cherished desires. Immediately after the New Year, Tenney expects to start on a voyage of discovery to the other side of the globe. The trip begins at New York, proceeds to the Pacific by way of the Panama Canal, and then a grand tour of Pacific ports and countries will follow: a few days in Hawaii, thence to the Asiatic coast with stops in China, the Philippines, Tahiti and other islands, and so on to Sydney, Australia, where several days will be spent. On the return voyage, Tenney will visit New Zealand, cross the Southern Pacific to Cape Horn, and return to New York by way of eastern South America, with brief calls at Buenos Aires, Santos, and Rio Janeiro. It should be a marvelous way to see much of the world on the other side of the globe and to avoid the rigors of our New England winter, which, by the way, has thus far been as mild as warm milk. Tenney hopes to meet some of the Technology men scattered through the distant lands, and has taken a list of addresses of a large number of our graduates. In a letter acknowledging receipt of some of these addresses, Tenney writes: "I do not know whether time will permit me to call upon many of these, but I shall make every effort to do so, as I want to get in touch with people in different parts of the world so as to select a good place in which to spend my last years on this earth." New England, Al, New England! We could not think of you as planted elsewhere.

Once more the Grim Reaper has invaded our ranks. The Secretary has learned with great regret of the death of Milton F. Jones, long a much respected and useful citizen of Natick, which occurred late in November at the age of 71. Jones entered the Institute in 1890, after having been in active business for ten years. He was, therefore, much older than his classmates but none the less interested in them or in the Institute. He took the course in Chemistry, and those of us who were his course mates will always remember with gratitude and affection the quiet but always effective influence which he exerted, and the spirit of helpfulness which he always manifested. With his greater maturity and experience he was able to advise and assist the younger men who were struggling with the same problems, and to set an example of industry and steady application to the work in hand. This, combined with a real sense of humor, made him an extremely popular man in the little group making up Course V in '94. After leaving the Institute he at once became connected with the New England Underwriters Insurance organization as a special inspector, and remained with this organization until he was retired about three years ago. Problems of special difficulty were assigned to him, and he rose to an important administrative position as manager. During his whole career he was also connected with civic and business interests, especially one or more of the banks, in Natick, and after his retirement devoted much time to them and to numerous helpful organizations in the town. He was a former chairman of the Natick public works commission, former town auditor, and former member of the town advisory board. He was auditor of the Henry Wilson Coöperative Bank and a member of the Meridian lodge of Masons and the Natick Country Club. For years he has been regarded as a leading and most useful citizen. His whole career was one of real service, and he was an honor to the Class and the Institute. We shall miss him greatly.

Many British papers have carried descriptions of a new process for the production of dehydrated apples which is being developed in the Annapolis Valley in Nova Scotia by the I. S. Simms Company of St. John, N. B. Technology's interest in this lies especially in the fact that the fundamental research leading to it was carried out under the supervision of Prescott and his associate, Dr. Bunker, in the laboratories of the Institute, under a coöperative arrangement between the company and the Department of Biology and Public Health. This is but one of the developments in Food Technology that has been assisted in this manner, and its growth to an important industry will be watched with interest. — SAMUEL C. PRESCOTT, *Secretary*, Room 10-405, M. I. T., Cambridge, Mass.

1895

Dear Mates: Your secretaries are almost "broke," paying for subscriptions to prominent daily newspapers in order to learn what men of '95 are doing. Every now and then we are rewarded, and the press now tells us something of Latimer Willis Ballou, of Woonsocket, R. I., and Bank Commissioner of the State of Rhode Island.

The Boston *Transcript* of December 17 contained an interesting article on the condition of banks throughout the country, and emphasized the strong position of the banks of the State of Rhode Island. We quote the following: "There must be reasons for the excellent condition of banking in Rhode Island. Latimer W. Ballou, the bank commissioner, will not take any credit for it himself. But, he says, in a tight little state like Rhode Island with strong banks and a branch system, the strong banks ready and will-

1895 Continued

ing to help the weaker ones, nothing much can happen to upset the system. The smaller banks in the state, he pointed out, do a work that the larger ones cannot do. They have a school for foreign depositors, teach them the uses of the bank, and how to write their names on checks. They are acquainted with the intimate domestic problems of these foreign depositors, who are a large and thrifty group. Industrious and good citizens, they gradually build up accounts which are too big for the small banks with which they start their deposits. They then become customers of the big banks which, appreciating the importance of the little banks as feeders, are always ready to extend a strong arm in their direction in time of stress. So secure does the commissioner feel that he has no hesitation in saying that Rhode Island faces the future with no apprehension that its record of no failures will be broken. He paid his tribute to the people of the state. They are, he said, sane and industrious. They have carried on through these times without extensive recourse to their savings. Losses have not been large and there has never been a sign of panic." We understand that Vermont has the same good record.

Gerard Swope was initiated into the honorary engineering fraternity, Technology Chapter of Tau Beta Pi, at Boston, on December 5. Among some of the things he said: ". . . Worry about the future is for old men and young men just entering business need have little fear for the future. Because of the depressed condition of business at present, those men entering the engineering profession today are going into it at a time of great promise." — LUTHER K. YODER '95, *Secretary*, Chandler Machine Company, Ayer, Mass. JOHN H. GARDINER, *Assistant Secretary*, Graybar Electric Company, 420 Lexington Avenue, New York, N. Y.

1896

Frank Hersey reports that Jim Melluish still continues very consistently to send advance notices of his proposed descent upon Boston, but every notice postpones the date of the descent. The last word received was that he confidently expected to arrive sometime in January.

Arthur Baldwin, who also hoped to be in Boston in December, had not shown up at the time these notes were written, two days before Christmas.

Fred Crosby, who had been General Manager of a group of Chicago hotels for two years, finally found himself out of a job as the result of bank failures which had brought about a series of five receivers for these enterprises. Fred therefore moved along to Detroit to take charge of the two Whittier hotels which are located on Burns Drive, and are now combined into one, with a total of 800 rooms, forming the best apartment hotel in the city. As always Fred extends a cordial invitation for '96 men to drop in and see him. The Secretary speaks from experience in saying that Fred always did dispense a fine brand of hospitality.

Marshall Leighton, who is with the Electric Bond and Share Company in New York City, says that he is still working, and very busy, but that is about all he can say.

Harold Stevens is another New Yorker who, as a graduate of Course IV, has been finding things rather slow along architectural lines, but he continues to maintain his office in Hempstead and to live in Sea Cliff, and finally to maintain an optimistic viewpoint for the future as indicated by his definite promise to be on hand at our next five-year reunion in 1936.

Paul F. Johnson '98, who is known to many '96 men, and who is located in Los Angeles, wrote to the Secretary that he recently had the pleasure of attending a meeting of the Los Angeles Section of the American Society of Mechanical Engineers and heard a very interesting talk by Paul Litchfield, who spoke on the advantage of a six-hour day and the five-day week as a part of the work-sharing plan which should help very materially toward getting us back to prosperity. Unfortunately, Johnson did not find it possible to meet Paul personally on that occasion.

The Secretary has just learned that Johnny Hallaran came east last summer from Toledo and spent a couple of weeks at Ogunquit, Maine, and also a short time in Boston. Furthermore, he followed his usual procedure of not establishing any contact with either of the secretaries at the time of his visit. Matters in Toledo are apparently about the same as in other parts of the country, except that perhaps a larger number of banks closed in that district than was the case in other sections of Ohio and contiguous states.

Bradley Stoughton is characteristically busy on his job of teaching at Lehigh University, and is also doing his bit to relieve unemployment by building a new house, thus helping some men who would otherwise be in serious circumstances.

Classmates will all sympathize with Joe Clary over the loss of his dear wife on November 26, after a long illness involving several severe operations. Joe is still with the Bureau of Construction and Repair of the Navy Department in Washington. His daughter expects to graduate from Sweet Briar this coming June. One specially interesting item from Joe was the pleasant contacts his family had with Con and Abby Young while the latter were in Washington in November on their way south to Fort Myers, Fla., for the winter. Con had a cold in Washington, which delayed them somewhat, so that they did not leave that city until December 2. It is most unusual to have to report information about Con in this indirect manner, because he usually maintains close contact with the secretaries during the time that he is at his summer home on Cape Cod. This year, much to the regret of the secretaries, Con failed to show himself in Boston, but we hope that sometime during the winter he will favor us with one of his usual breezy reports for the class notes.

We left the Fullers at Stanleyville. Now go on. "Today, February 21, finds us at Tabora, at an altitude of 3,500 feet on the Tanganyika Highlands south of Victoria Nyanza, after 12 days of jumping from train to steamer and steamer to train on our way across Africa.

"We left Stanleyville on February 9 on a train of coaches, captured locally by the Belgians from the Germans in the late war, for the 80-mile trip around the second rapids, or Stanley Falls, of the Congo, with a drop of 200 feet. European plantations alternated with jungle and thatched villages, the natives unclothed except for breechcloths or narrow string-skirts and decorated with paint or scar designs, occasional nose and ear plugs, and sometimes with hair dressed in elaborate and ornamental patterns.

"Next came 200 miles by steamer on the upper Congo, now known as the Lualaba, to the third rapids. This was through the elephant country and ivory tusks were seen at several landings. A group of some 25 big black monkeys leaped from tree to tree as we passed.

"The third rapids, continuing for 225 miles, were passed in a train with compartment sleeping and dining cars. Elephants were still common and the destruction by them of native gardens only the previous night was reported. The region is the western edge of the tract made infamous by Arab slave raids and terrible cruelties in the days of Livingstone, and the Mohammedan descendants of the raiders, dressed in long white robes, are common. Old men are pointed out as having themselves been raiders in the old days, while aged natives claim to have been with Livingstone. Several missionaries from the United States joined us until there were twice as many Americans as other whites on the train.

"Above the third rapids, we once more boarded a steamer for 50 miles on the river. The jungle, through which we had been passing for nearly 2,000 miles, gave way to broad savannahs of six- to ten-foot grass and tall papyrus, while an occasional hill began to be seen.

"At last leaving the Lualaba, or Congo, which we had entered from the sea a month before, we began a 170-mile climb through sandstone hills with coal to Lake Tanganyika, discovered by Burton and Speke in 1855. Originally supposed to be the source of the Nile, it was later found to discharge into the Congo. The night of February 14 found us crossing the lake by steamer. Occupying a great 'rift' valley, or downthrown block of the earth's crust, it is, next to Lake Baikal, the deepest in the world, soundings showing its bottom to be 4,190 feet below its surface, which stands at 2,550 feet, or over half a mile below the level of the sea. Rimmed by mountains, it is quite scenic in places.

"We landed in Kigoma, on the east side of the lake, on the morning of February 15, visiting the adjoining native town of Ujiji, once a great slave center and famous as the spot where Livingstone, long unheard from, was found by Stanley in 1871. The same evening we

1896 Continued

once more boarded a train for the climb of another thousand feet to Tabora on the Tanganyika Plateau, 250 miles east of Lake Tanganyika and a similar distance south of Lake Victoria. Here we have spent five days waiting for a train to the latter. It is another of the former slave centers where Livingstone once resided. The stay has been relieved by a visit to the chieftains of the district, who received us with enormous drums so high that the natives had to stand on benches to beat them.

"Yesterday a swarm of locusts appeared from the east like a rolling cloud of thick smoke, darkening the sky and passing over, fortunately without stopping, with a noise like wind blowing through pine trees. The flight lasted an hour, and must have covered many square miles. — Tanganyika was German territory before the World War and many are still there. Our hotel, which is very comfortable, is under German management.

"A wireless message picked up this week saying America had declared war on Japan stirred up the Americans here, but fortunately seems to be a false alarm, as there has been no verification.

"We are off for Lake Victoria this evening." — CHARLES E. LOCKE, *Secretary*, Room 8-109, M. I. T., Cambridge, Mass. JOHN A. ROCKWELL, *Assistant Secretary*, 24 Garden Street, Cambridge, Mass.

1898

Paul Johnson writes that he is taking his yacht up to Canada to lay her up in fresh water. Apparently this plan will lessen the expense of upkeep, which is an important consideration with him as with the rest of us. He hopes to get a charter or two to Alaska next summer.

In reading about the St. Lawrence Waterway in the *Transcript* of November 29 we found that Brigadier General George B. Pillsbury, assistant chief of Army engineers, had been giving some authoritative estimates of the cost of the project to the Senate committee. Pillsbury spent two or three years at M. I. T. with our Class and then transferred to West Point. The last we had heard previously, he was Lieutenant Colonel of Army engineers, in charge of U. S. lake survey, and a member of the Joint Board of Engineers on St. Lawrence Waterway Improvement.

George Cottle gave a travel talk before the M. I. T. Faculty Club on December 21, showing his films of the Island of Bale, Upper Burma, and India. George has not been an aimless traveler in search merely of excitement, but he has studied the history and the customs of countries and he gives a charming talk to accompany his very artistically taken pictures.

Charley Hurter, after years of service as explosive expert with the du Pont company, has retired with a pension and has located at St. Petersburg, Fla. — Robert M. Draper dropped in a few days ago. He has been running a copper smelter for the Soviet Government in the Ural Mountains. He is very well satisfied with his treatment over there. He seemed to feel a lot of friendliness for the Russians, and to see in their present political order at least a sincere attempt to improve their civilization. — ARTHUR A. BLANCHARD, *Secretary*, Room 4-160, M. I. T., Cambridge, Mass.

1899

As '99 has been conspicuous by its absence from the last two issues of The Review, it is high time that we salvage our reputation if that be possible. But Israelites making bricks without straw had nothing on a columnist who must fill space without news — which has been the situation for some time. It is one that I called feelingly to the attention of C. B. Cluff of Ivorydale, Ohio, and Hervey Skinner of Boston, when each waylaid me in a hotel corridor in Washington this month during the sessions of the American Institute of Chemical Engineers.

Hervey promptly accused me of always hounding him for news, whereupon I countered that I'd keep on until I got some, whereupon he told me of the work of his firm in smoking out the deceivers in the famous Black Tom case which was recently decided in favor of Germany by Associate Justice Owen J. Roberts of the United States Supreme Court, and umpire of the Mixed Claims Commission. Not so long ago and even today in some countries the things Hervey and his associates did to determine the authenticity of certain documents would have been termed "Black Magic." That the documents were not authentic but were instead forgeries was discovered and proved beyond all shadow of a doubt. Letters supposedly written in 1917 were shown to have been written in 1931 and he who would deceive the eyes of science must be more wary than he who would sup with the Devil. Hervey was doing some work also in connection with a claim in the Wendel will case in New York, but the Judge threw the case out of Court the day before he was to testify.

Norman Seavey is spending the winter at his cottage in Hollywood, Fla., and if the weather permits, I shall stop and have a chat with him sometime this winter. — Jerome P. Jackson can be reached through R. F. D. No. 1, Sandy Hook, Conn.

It is with regret that I announce the death of Alfred N. Fessenden, Townsend, Mass., on November 11. — W. MALCOLM CORSE, *Secretary*, 810 18th Street, N. W., Washington, D. C. ARTHUR H. BROWN, *Assistant Secretary*, 53 State Street, Boston, Mass.

1900

Tom Perry's article in the October Review, "The Need for Engineers in the Woodworking Industry," has brought forth a great deal of favorable comment both from the engineers and from the officials in the industry. It would pay us all to read it again. Nice work, Tom.

Four of the best represented the Class at the last meeting of the Council and had a good time reminiscing. They were: Bowditch, Russell, Charlie Smith, and Ziegler.

News from Chicago gives E. G. Allen's new address. A letter is expected hourly with all the details which will appear in a later issue.

The Boston *Globe* on November 29 published a story about Major Stevens, a victim of amnesia, who was brought to a conscious realization of his identity in San Diego, Calif., where an unexplainable wanderlust had carried him. This is the Ralph Stevens, III, of our Class, now safely returned to his home in Whitman, Mass.

It was the scribe's good fortune to be present, together with Ingersoll Bowditch, at the December meeting of the Rotary Club at the Hotel Statler and to listen to our own Charlie Smith, Vice-President of the New Haven Railroad, on the "Present Railroad Situation." The speech was a very thorough portrayal of the problems of the railroads and was enthusiastically received by the 500 members. The only regret was that it was all over in a half hour.

The last issue of the bulletin compiled by the officers of the State Highway Department of New Hampshire had an interesting account of the pilgrimage through Virginia of the American Association of State Highway Officials in connection with the dedication of the Mount Vernon Memorial Highway in November. The President of the Association, Fred Everett of New Hampshire, is shown in several of the accompanying photographs and looks as natural as ever. — C. BURTON COTTING, *Secretary*, 111 Devonshire Street, Boston, Mass.

1901

I seem to have acquired the habit of writing class notes on holidays, legal and otherwise. This being Christmas day and at least a technical holiday, I sit me down as usual to offer my chronicle of small beer — this latter being merely a felicitous reference to the recent activities of the Federal legislative body. Also, in the good old days before the Volstead Act came to cloud our happiness, beer was associated with the genial doings regarded as seasonable, timely, and appropriate at this theoretical time of rejoicing. So, having passed the implications of Thanksgiving with no more than an occasional involuntary and controlled regurgitation, I make no bones about offering you my felicitations at this season of the year, express the pious hope that your New Year will be bright, happy, and prosperous, and sit with folded hands to await the explosion that these optimistic words may excite in you when you read them two or three months from now. I wish I could be a little more specific as to the probable time of their appearance but I have never been able to catch up with the editors of The Technology Review and so I lag painfully behind the calendar as ordered by them. Well anyhow, I have one really interesting piece of news for you and, what is more to the point, something in which we can all genuinely and sincerely rejoice.

Nat Patch writes to me that in or about this holiday season he is to lead Miss

1901 Continued

Ethel Chapin of Buffalo to the altar and that thereafter, so far as we both know, I shall occupy the unique position of the only unmarried man in the Class. And, boys, it is a distinction which will be relinquished only over my dead body. (Irish Free State *News*, please copy.) In view of Nat's impending happiness, in which I know we all genuinely rejoice, this may seem like an ungracious comment but those of you who know Nat — and me — realize that the circumstances are far from parallel. With Nat's urbanity, his gracious dignity, and his genuinely good disposition, it is only appropriate that he should round out his career with the years of a happy domesticity which I for one both wish and predict for him. I am planning to visit Buffalo this spring primarily that I may have the pleasure of meeting Mrs. Patch who is soon to be, if she not already is, and conveying my congratulations in person, as I know each one of you will do if like opportunity presents.

Shuffling over some of the more recent sheets which have come to me, I chance on two or three notes from Ralph Whitman, a captain in the Navy and Public Works Officer both of the Mare Island Navy Yard and of the 12th Naval District. Ralph seems to have a happy knack of picking up stray bits of news which are always interesting to me and which at times are of a character that permit repetition in these columns. Having indited my last letter in the manner — though not the English, alas — of the Spectator, I make bold to repeat a little anecdote which is in one of his latest communications. Referring to a well-known member of the Class much in the public eye, Ralph recalls the tri-weekly repeated episode of one of the brothers Bernard who, in the French class when calling the roll, would run down the list "Monsieur this, monsieur that" and then suddenly "Herr-r-r*******!"

Bill Vermilye has undergone a metamorphosis and whereas for several years we have identified him with the conduct of the dye and other organic chemical industries in this country, he suddenly emerges destitute of any chromogenic attribute save that implied in his patronymic by the late Freddy Boyd — himself a somewhat colorful person. Bill is now recorded as Chairman of the Board of the Hat (presumably high) Corporation of America, director of the Moscow Fur Trading Company, which is limited in London but incorporated in New York (these be twins, I imagine, of at least the same mother) and he is also Treasurer of the Eitingon Schild Company, which to me, a country mouse, carries but little significant connotation. Breaking it down as one does, I believe, in various forms of analyses, I recover an egg, a targe, and the pleasing sound that results when the one hits the other. Perhaps if Bill's eye meets this, he will disclose to me the true inwardness of this seemingly heraldic designation. Anyhow, though we may not know just what Bill does, the "Moscow Fur" carries me back to a pleasing picture of my childhood in which the sorely beset driver of a troika was limned hurling his child — or possibly some one else's — to the ravening wolves that follow him. It always gave me a thrill of pleasurable anticipation to see that picture — there really is a lot to be said for King Herod — and one of Bill's new jobs has evoked a tender memory of the past.

Ralph Stearns wrote in during the summer when he hadn't enough money to do anything "interesting." This I assume is a reflex of that Twentieth Century Sardanipalian luxury that so distinguishes our one real metropolis where, in the words of the Scriptures, "they build penthouses and inhabit." Some bright lad is going to try and identify that quotation and I'll tell him now he won't find it.

Well, Christmas day is slowly coming to an end, but old dear friends arouse ye in the thought that its decline is a presage of 1933, and in that year of grace and the Democratic party, the Class of 1901 holds its Thirty-Second Anniversary. Vermilye will be there; Joe Evans is pledged; Arthur Hayden is hopeful; Nat Patch is assured unless happenings during the holidays interfere — he says "God willing" but I translate that in terms of Mrs. Patch; Teddy Taft, Bill Sweetser, Sol. Stone, Bill Dow, Lammot du Pont, and Leroy Backus all the way from Seattle are but a few of the pledged. So goodnight and a Happy New Year. God rest you merry, gentlemen.—ALLAN WINTER ROWE, *Secretary*, 4 Newbury Street, Boston, Mass.

1904

As you all know, these notes are always written at least a month before you read them, so I hope you all enjoyed a very merry Christmas, but as most of the year is still ahead of us I can certainly wish that you have a much more prosperous New Year than the last one may have been. As I write these notes the well-known depression seems still to be in our midst but like a sore thumb or a chronic stomach-ache we have become more or less used to it and get along with it as a necessary evil, but we can all still hope that the bright spot is still "just around the corner."

Under date of November 1, I received a letter from Phil Sweetser, who was formerly located in Boston with the firm Sweetser, Coffin and Fuller, Investment Counselors. Last February the office of the concern was shifted to Philadelphia and the letter informs us that the name of the concern is now Sweetser, Sheppard and Deakin, with offices in the Packard Building, Philadelphia.

Mr. and Mrs. Harry Rollins announce the marriage of their daughter, Victoria Webb, to Mr. Lucius Archibald Andrew, Jr., on Saturday, the fifth of November, at Des Moines, Iowa. Mr. and Mrs. Andrew will make their home in Evanston, Ill.

Bob Palmer has been made Head of the Mechanical Section of the Research Laboratory of the General Electric Company at Schenectady, N. Y. He has been connected with this Laboratory for many years and we are glad to hear of his promotion.

I am indebted to Professor Locke for the following note:

". . . Robert Faulkner, who is Superintendent at the Lebanon plant of the Bethlehem Steel Company took two months' leave of absence this last summer and, accompanied by Mrs. Faulkner, made a trip to Europe. It is understood that he spent much of his time in Paris, and the reports are that he was enthralled with the scenery. However, details received are extremely meager and the fact that Mrs. Faulkner was with him probably had a steadying influence. Nevertheless, one fears that on this first trip of Faulkner's to gay Paree he may have stepped out once or twice."

O. G. Thurlow has been requested by the Reconstruction Finance Corporation to assist the Advisory Committee of the Birmingham District in passing on requests for loans for self-liquidating construction projects. There are 37 engineers thus honored in the entire country. They serve without remuneration other than travel allowances. Thurlow was in Boston around Thanksgiving time and I had lunch with him and Mert Emerson.

The Boston *Herald* of December 21 carried an article on the proposed construction of a highway on Plum Island, extracts from which are given below: "The Legislature will be asked next month to give its approval to a self-liquidating project for the construction of a 10½-mile boulevard from Ipswich to Salisbury, which would open to the public miles of now inaccessible beach on Plum Island and provide a shorter and direct and continuous ocean drive from Ipswich to Portsmouth.

"The road, which would be known as the Essex shore way, would include two toll bridges, the revenue from which would go to amortize their construction cost of $2,000,000. One bridge would cross the Merrimack river and the other would be built over the Plum Island river.

"The project's sponsors will seek the aid of the Reconstruction Finance Corporation in construction of the road and bridges, and have filed a bill in the Legislature to incorporate the Essex Shore Way, Inc. The approval of the Federal Government is necessary also, since the Merrimack river is an interstate navigable stream.

"The proposal is the idea of O. G. Thurlow, a Vice-President and Chief Engineer of the Commonwealth and Southern Power Company, who has a summer home at Salisbury. Associated with him are Roland M. Baker, former postmaster of Boston, J. Sumner Draper, W. W. Gallagher of Needham, and Merton L. Emerson of Boston and Braintree.

"Under present plans the entire project would be turned back to the state free after a term of years, during which the original cost would be paid back through the collections of tolls at the two bridges.

"Because of the scheme's self-liquidating character, the group declares the work may be started at once, with consequent

1904 Continued

aid to employment and considerable economy because of current construction costs.

"The engineers for the project are Fay, Spofford and Thorndike of Boston, who designed and supervised the construction of the bridge across Lake Champlain, the Memorial bridge at Springfield, the army base, and other structures."

It is apparent from the foregoing that certain members of our class are doing their bit toward the ending of the depression.

I received word from Fred Pirie that some time during the past summer Edwin T. Wood, II, died at his home in Steubenville, Ohio. Fred knew no particulars but passed along the information of Wood's death.

This completes the items of interest which I have gathered together at the present time and with these you will have to be contented until the April issue, when I hope to have some more notes for your edification. — HENRY W. STEVENS, *Secretary*, 12 Garrison Street, Chestnut Hill, Mass. AMASA M. HOLCOMBE, *Assistant Secretary*, 3305 18th Street, N. W., Washington, D. C.

1905

From Irving Cowdrey, II: "I am only a 'grumpy old prof.' not doing a thing except to try to teach the usual selection of hope-to-be engineers, and get enough of the coin of the realm to give two girls a start in life which will be at least as good as I had. My older daughter, Corinne, received her B.S. in Education at B. U. last June, having specialized in economics. She expects to break into the teaching game as soon as the economy streak eases up a bit and lets the public again think of the less essential features of public school education.

"The younger daughter, Barbara, is now at the N. E. Conservatory of Music, specializing in public school music and, incidentally, doing rather unusually good work on the trombone. You see the whole family gets good wind from the old man.

"As to photography, I presume you have had an echo from a picture talk I gave in the old John Elliot church at Roxbury about a month ago. Sid Strickland and Andy Fisher kept awake the whole evening. So I conclude the meeting was a success — Q. E. F. (sic, Sec. '05).

"As to my start in photography. As far back as I can remember what a camera was for, I have always wanted one. My good old grandma bought me a little toy when I was about 12, then I owned a Brownie when in Tech and later a Corona. For the first seven years of teaching here at the Institute I was with Professor James. He was an ardent amateur and used to make a great many lantern slides both for his own pleasure and for the M. E. Department. From him I learned the principles of lantern slide work.

"About 1917, wanting a new camera, I consulted with R. R. Lawrence who advised the vest-pocket Kodak, then being made for the first time with a high-grade lens. Since taking his advice, I have used nothing larger. In fact my present pet is a German camera made by Dr. Nagel, called the 'Pupille.' It has an f 3.5 lens, uses vest-pocket size film and makes 16 exposures to the roll. It is giving me marvelous results using the 'Verichrome Films' which from that size will make 8 x 10 enlargements with no loss of detail.

"As to coloring lantern slides, that has bloomed out of my inherent egotism. I just made up my mind that I could do color work, then did it. Some of my old slides colored ten years ago look a bit sick to me now. As to the present results, ask Sid and Andy."

From Tom Estabrook, V, Brown Company, Berlin, N. H., in explanation: "I had a fine recovery from my breakdown, spending 70 days on the staunch and able motor cruiser, *Valient* where, with my wife and part of the time my boy, I spent most of the summer. We lay at a mooring in Decker's Cove, Southport, right in the heart of the finest cruising country that I have ever seen, and the time spent put me on my feet, I am glad to say.

"I have been working harder during the last two months than I have worked for 20 years, but it is a great experience for me. Having a finely organized and smoothly functioning department under one's charge is, after all, somewhat enervating, and there is certainly nothing enervating about this job I am on now." (In the manufacturing end at the Cascade and Riverside mills which are the paper departments of the Company.)

Tom W. Osgood, III, who has long been missing, is Assistant Superintendent of the Industrial Accident Commission, in the Department of Industrial Relations of the State of California, 602 California State Building, 217 West First Street, Los Angeles, Calif. For the past 15 years he has been attached to this Commission. The work is primarily that of accident prevention, which embraces a wide variety of engineering in mining, tunneling, building, and engineering projects and, in short, in all places of employment in California. For ten years prior to this service he had been in private engineering practice in the State of Oregon. For this news we thank Professor Locke.

From Forest Sprague, V, whose address is now Callicoon, N. Y.: "I am just here temporarily, to be near some relatives of my wife. Also near New York and Endicott, where I go to visit friends in the tannery. Callicoon is in the foothills of the Catskills, just 100 miles east of Endicott. I resigned at Luray, Va., last summer and have gone in for myself, temporarily, until business picks up and they stop cutting salaries. I have a good short tannage for sole leather, and have just been in Canada for a few months, where I demonstrated and sold it to a large company. I may be in this business for a while and may go anywhere, but when I get located where it looks permanent, shall let you know my address."

Bob McLean says that he gets into Boston from East Bridgewater often enough but doesn't see any classmates. He admits "in a business way, I see Herman Gammons who, as you know, is a patent attorney and who, I believe, now has a boy at Tech." Which may be so, but we recall with envy his drawing the Ciné Kodak at the famous Jamboree. Bob says that he saw Grove Marcy and John Damon at a recent Alumni Council meeting. — Frank Carhart is a new member of the Alumni Council. He says that he "accepted with some misgiving since my business carries me away from home so often. However, I have arranged with John Damon to pinch-hit for me when I have to be away." We tried to learn something about these trips but Frank says they are "entirely of a business nature and — 16 hours every day," and so on.

From Walter Brown, III, at a new address, Sussex County Trust Company, Franklin, N. J.: "I was not aware that anyone knew of my recent move, nevertheless I should like you to know I appreciate very much your friendly note of December 5. Middletown is not very far away from Franklin, I believe, and if you are ever in this vicinity I hope you will give me the pleasure of meeting you. [Wrong Middletown. Sec. '05.]

"When a man recalls my farming experience to me it rather implies he must, at sometime or other, have listened to the relation of at least a few of the woes which befell me in that connection. I do not believe, however, that we have ever met one another. [He once raised pure-bred cattle. Sec. '05.]

"The first sentence of your letter implies that I am still an employee of The New Jersey Zinc Company but that is not the fact, as my connection with them ceased on November 30, when I became the Executive Vice-President of the Sussex County Trust Company. I am fortunate, however, in being able to continue the deeply valued friendships with all those connected with The New Jersey Zinc Company. It is a long jump from mining engineering to banking. Whether this jump is up or down, time will tell."

From the Alumni Office came news of the death on July 26, 1932, of David Collins. For some years he has been out of contact and it is impossible to present a proper obituary. From our Ten Year Book, we find that he was born at Bourne, Mass. He left the Institute at the end of his junior year and until 1906 was with the Engineering Department of the N. Y., N. H. and H. R. R. in Boston. He then entered the construction department of the Pennsylvania Railroad at New York and, in 1916, was chief draftsman in the Maintenance of Way Department. He was married, had two daughters, and had been living in Richmond Hill, Long Island, N. Y. — ROSWELL DAVIS, *Secretary*, Wes Station, Middletown, Conn. SIDNEY T. STRICKLAND, *Assistant Secretary*, 20 Newbury Street, Boston, Mass.

1906

Classmates who read the December Review probably noticed that the feature article of that issue entitled "Elbow Room for Industry" was written by Harold Coes. Thus does Harold attain the

1906 Continued

distinction of a writer in addition to the other achievements which he has accomplished in his active career since graduation.

Those of us who live in New England are so situated that it is not difficult for us to follow Harold's advice to get elbow room in the country a few miles from the seat of our vocations.

About five years ago, your humble Secretary followed this plan by moving to a place having nearly an acre of land, not to mention fruit trees and other natural possibilities. Incidentally, it is also convenient to an 18-hole golf course. Speaking from experience, this combination is not conducive to farming and to date it has been fortunate for the Secretary's family that they have not been too dependent on the products from this farm for sustenance. However, we subscribe to Harold's idea but respectfully add that decentralization should be based upon a definite decision to either farm or golf, as the attempt to do both will not permit great progress along either line.

As evident from the preceding paragraph, the writer is hard pressed for news this month and past experience does not give him much confidence in attempting to create material of his own imagination. It is significant that at the beginning of our notes last month we requested the coöperation of classmates in submitting items of interest. Not as a result of this but by the decree of cruel fate, we are now depending upon a few meager clippings obtained from the Alumni Office through the Clipping Bureau to which they subscribe.

The first of these was taken from the New York *Times* of October 30 and concerns the possibility of the northern North Atlantic route for airline use as contained in the report of one of the two commissions into which the International Congress of Transoceanic Aviators, which met in Rome last May, resolved itself. The commission, headed by Commander H. C. Richardson, U. S. N., retired, (XIII-A), makes the following report on the Labrador, Greenland, Iceland route in the current *Geographical Review*. "With existing equipment this route could be flown," it says, "as it affords intermediate stations at reasonable distances. It would be necessary, however, to establish complete meteorological and radio services and many landing and maintenance facilities. A definite survey of each step should first be made to determine the variation in route necessitated by daily and seasonal changes in conditions. Attention is drawn to the fact that during the summer fog seldom extends far inland or over inland waters and that generally when there is fog on one coast of Iceland it is clear on the other coast. This applies also to Greenland. It would be necessary to have alternate landing fields in both countries and have traffic directed by radio as circumstances required. It is considered that all-year flying is possible over Greenland to Iceland, but that difficulties would be met in the form of icing of machines and irregular, suddenly changing, strong winds in the North Sea section during the winter months. It is considered that flying boats could land and take off from the deep snow on the Greenland plateau and that lake landings in the northern areas would be possible except during two short seasons of the year."

The Boston *Transcript* of November 7 made the following reference to Mrs. Johnson O'Connor (Eleanor Manning): "Mrs. O'Connor will be the guest of honor at a dinner tomorrow at the College Club. At eight she will give an illustrated talk on 'Old New England Houses.' Mrs. O'Connor is a graduate of the Department of Architecture at Massachusetts Institute of Technology. In her practice of architecture she has made a special study of old Colonial houses." It is interesting to note that marriage does not seem to restrict the many activities for which Mrs. O'Connor has been noted.

The death is reported of James S. Bell, Jr., who died at his home, 47 Kenmore Street, Newton Centre, on December 15. Bell was at the Institute but a short time and had shown no interest in Tech affairs since graduation. At the time of his death he was in the candy manufacturing business, having followed in the footsteps of his father.

The last clipping contains the statement that Mrs. William C. Andrews (Mary J. Ruggles), VIII, is with the Research Laboratory of the General Electric Company at Schenectady, N. Y. As the card in the Secretary's files has recorded this information on May, 1915, we doubt if this can be offered as news. It is an indication, however, of the scarcity of interesting items for this issue.

The classmates who have read the notes to this point should be moved to do everything in their power to prevent a repetition of the condition which they are obliged to endure this month and deluge the Secretary with items for the next issue. With this parting shot, the Secretary retires from his literary work to enjoy the Christmas holidays. — JAMES W. KIDDER, *Secretary*, Room 505, 261 Franklin St., Boston, Mass. EDWARD B. ROWE, *Assistant Secretary*, 11 Cushing Road, Wellesley Hills, Mass.

1908

When your Secretary was recently in Cincinnati, he had a chance to see Howard Luther. Luther and his family were leaving shortly to spend the winter in Switzerland, where his daughter will be in school.

Hardy Cross, who is Professor of Structural Engineering at the University of Illinois, has recently published an illuminating article for the benefit of the American Society of Civil Engineers on "Analysis of Continuous Frames by Distributing Fixed-End Moments."

L. E. Wemple, who is President of the Illinois Zinc Company and also of its subsidiary, the Peru Mining Company, has been visiting the Peru Company's mine and mill at Deming and Hanover, New Mexico. — HAROLD L. CARTER, *Secretary*, 185 Franklin Street, Boston, Mass.

1909

Morris Knowles, Inc., announces the renewal of the association with their organization of Maurice R. Scharff, Consulting Engineer. "Mollie" will, however, continue his own independent professional practice of public utility engineering, valuation and rate problems, and at the same time act in a consulting and advisory capacity to Morris Knowles, Inc., in the field of sanitary and public works engineering and city planning.

Francis Loud has returned to the Boston office of Jackson and Moreland, having been in New York for some time in connection with the electrification work on the Lackawanna Railroad. At the completion of that work, he remained in New York to look after that office of Jackson and Moreland until recently, when another man took over those duties and Francis came back to the home office.

Charles R. Main was included in a group of about 40 engineers invited by President Hoover to dine with him at the White House on December 17. While in Washington your Secretary was the guest at luncheon of Harry Whitaker, who is assistant to the Engineers Advisory Board of the Reconstruction Finance Corporation. — CHARLES R. MAIN, *Secretary*, 201 Devonshire Street, Boston, Mass. PAUL M. WISWALL, *Assistant Secretary*, General Foods Corporation, 250 Park Avenue, New York, N. Y. MAURICE R. SCHARFF, *Assistant Secretary*, 1 Wall Street, New York, N. Y.

1910

Not much grist for the secretarial mill this month. The boys must have been too busy writing Christmas cards to bother writing for The Review.

John Lodge writes on his letterhead of Berlin and Jones Company, 601 West 26th Street, New York: "Here is an answer to yours of October 31 — a little late but you can probably use it sometime. I haven't anything new to report. Although I work in New York, this location is so out-of-the-way that I seldom see any of our classmates. I have been with the concern for the past ten years and when I need a title I call myself Plant Engineer, though there is really very little engineering in it.

"I went to that swimming party in the Yale Bowl — otherwise the Harvard-Yale game — and saw Eddie Rice for the first time since we lived in Technology Chambers. He is another renegade engineer, being a banker in Schenectady. P.S. All class secretaries have my sympathy."

Guy Little writes from Herkimer, N. Y.: "I haven't much to write about myself since leaving Technology. I married in 1911, have two girls and a boy (18, 15, and 11, respectively). Have been in the ice business for the last 22 years and for the last five years have sold G. E. refrigerators. — Served one term as Village Trustee and been on Board of Education for last nine years. Haven't seen any Technology men for years. — I guess that's all, except I should like to extend greetings to my Technology friends."

1910 Continued

We have the following note from Professor Locke's office: "B. C. Huber, III, went to California from Technology and lived in various places. For the past few years, however, we have had no address for him, although I did not know of this situation until recently. I have taken steps to follow him up and have located him at Sierra Madre, Calif., where he owns a ranch. In the course of his life in California, he has accumulated a wife and three children." — DUDLEY CLAPP, *Secretary*, 40 Water Street, East Cambridge, Mass.

1911

At this writing, two more days — then Christmas. My thoughts are accordingly roaming all over the world wishing classmates a very Merry Christmas and a Happy and Prosperous New Year. Coincident with the business improvement which must soon follow, let us resolve to be less self-contained and more willing to let each other know what's new by the well-known method — write to Dennie!

On December 6 a nine-pound son, Samuel Todd Cornell, brought joy to the Garden City home of Sam H. Cornell, XIII, and his wife. Congratulations to the latest Junior member of '11 and his parents!

Ralph Sawyer, XII, mining engineer, told about 25 members of the Maine Mineralogical and Geological Society at Portland, Maine, December 1, that the limestone and reinforced concrete "fad" for building and construction work has run its course and the more durable granite, especially that from New England, is coming back. He added that the granite from the Hallowell region is some of the best in New England and "there is a chance for a live-wire business man with a sense of advertising to accomplish something in Maine granite. He also said that the Maine limestone industry had little chance, due to pretty hopeless small deposits.

Like the brook of Tennyson renown, Charlie Linehan keeps going, having been elected in mid-December to again be Secretary of the Massachusetts High School Coaches Association. He still coaches athletics and teaches mathematics at Rindge Tech in Cambridge. — In a recent letter from Don Stevens he said it was his pleasure on December 8 to introduce Harold M. Davis, I, at the joint meeting of the Taylor Society and the Society of Industrial Engineers at the Hotel Pennsylvania in New York City. Davis told Don that his "Share-the-Work" plan is working differently today from his original intent. Sometime later we hope to be able to present a real story of this plan of our modest classmate. Be patient, classmates, and we'll have the story.

The approaching New Year suggests taking account of stock, so let's examine the roster of officers of the 70 local alumni associations of M. I. T. We have nine '11 men as presidents and four others as secretaries. The presidents include: Tom Lathrope at Columbus, Ohio; George Forristall at Houston, Texas; Dick Ranger at New York City; Don Southgate at Nashville, Tenn.; Herb Angell at Portland, Ore.; Dennie Denison at Portland, Maine; Burleigh Cheney at Providence, R. I.; Syd Alling at Rochester, N. Y.; and Osborne Shenstone at Toronto, Ontario, Canada. The secretaries are: Lloyd Cooley at Chicago, Ill.; Wes Jones at New Haven, Conn.; Don Frazier at Richmond, Va.; and Bill Pead at Montreal, Quebec, Canada.

Three classmates have distinct new locations, but no response yet to requests for self-interest stories: Joe French R. F. D. 2, Concord, N. H.; Nate Levy, Hotel Hemenway, Boston; and Jack Romer, 1259 Delia Avenue, Akron, Ohio. Remember more letters to Dennie mean more class notes, and act accordingly. — ORVILLE B. DENISON, *Secretary*, Douglas Hill Inn, Douglas Hill, Maine. JOHN A. HERLIHY, *Assistant Secretary*, 588 Riverside Avenue, Medford, Mass.

1912

We are greatly indebted to Mrs. Mason, wife of Edward M. Mason, VI, for a fine contribution for this column. Ned has been traveling in foreign lands for the Standard Oil Company since last April and Mrs. Mason has very kindly summarized for us the news which comes to her in his letters home. She writes as follows:

"Ned is still away — will probably get back about the end of March. He cabled today he was leaving India and would spend Christmas in Cairo. He has covered the entire foreign field as, because of the Socony-Vacuum Merger, he had to get acquainted with the former Vacuum staff.

"After a splendid month in Japan (via Honolulu), he was a regular old Jonah in Shanghai. He was in the hospital for over a week with what they thought was appendicitis. He wrote an 'ethery' letter — operation was to be the next day — it was absolutely unsafe to let it go on, and so on — then no word for a long time and the next thing I heard he was off again — *no operation!* But he apparently has had no subsequent trouble. A fortunate escape, as the humidity was just a fraction under the saturation point, the mercury at 100 or above, and on all sides an epidemic of cholera. As soon as he left Shanghai he discarded his hard luck. There was a long stay in Hong Kong, with a run over to the Philippines. He went by boat to Saigon and overland through Indo China, Cambodia and Siam, and down to Singapore. In the Temple Ruins at Angkor Bat, they were wandering through a regular maze of old courts, one leading into the next, when they heard a hungry growl in the next court. Knowing it was either a tiger or panther, and as they were unarmed, they made no delay in departing.

"After Singapore came Java. It was interesting to me to have received a letter from Batavia in two weeks and two days. It went air mail to Amsterdam. Other mail took six weeks. He seemed to like Java particularly — it is so much cleaner than the rest of the Orient. And the vegetation is so luxuriant! He went by motor the length of the island to Soerabaia and back by plane. India was like coming home. He went from tip to tip and end to end and circled around in between — to Calcutta and Bombay twice.

"He sent a clipping, a weather report from January 1 to November 1 and the rainfall in one city in Assane (Cherrapunji) was 475.4 inches — 40 feet in ten months! From Cairo, he will go to Beirut (Syria) Istambul, Athens, and up through Jugo Slavia, making headquarters in Belgrade, then across Switzerland and France to London — and then I guess there won't be any place left, so he'll have to come home. He left in April — it will be a whole year.

"Of course it is intensely interesting to him although rather a heavy dose, but it's not quite so interesting for the family. My face has been getting longer and longer until I'm almost tripping over it. This depression takes on various forms and perhaps this a bit more savory than some; although I wouldn't recommend even this for one's family. . . ." Mrs. Mason, we surely wish you and Ned an early and a joyous reunion in your Ridgewood, N. J., home.

Our good friend O. B. Denison '11, always on the alert to help a brother Secretary in distress, sends us from the Boston Sunday *Post* a clipped article describing the new Rindge Technical School, in Cambridge, Mass., designed by Ralph Harrington Doane, IV. The article speaks very highly of the practical nature of the design as well as the beauty of this million-and-a-half dollar structure.

Your Secretary is happy to report that he has supplied a considerable amount of equipment for the school shops, including a portable crane for handling airplane motors and a smaller crane for handling automobile motors.

Many of our classmates are probably doing equally interesting and important work, but we never hear of it unless somebody stumbles by accident on a piece of news like this.

A Christmas note from Capt. Harold Mabbott, U. S. A., II, brings up fond memories of our Twenty-Year Reunion. He says he expects to have to go on foreign service before long, but hopes to be able to arrange it so as to be back here by the time the Twenty-Five Year Reunion rolls around.

Christmas cards and notes of greeting have been received from many classmates. Your Secretary and Assistant Secretary acknowledge them all with thanks and hope you will forgive us if we haven't answered them all in kind. We certainly appreciate your thought of us at the Christmas and New Year Season.— FREDERICK J. SHEPARD, JR., *Secretary*, 125 Walnut Street, Watertown, Mass. DAVID J. MCGRATH, *Assistant Secretary*, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York, N. Y.

1914

The only item that has come to the attention of your Secretary during the past month was a clipping taken from

1914 Continued

the Arizona *Mining Journal* and sent in through the courtesy of Professor Charles Locke. It relates to Charlie Thompson and reads in part as follows:

"Charles Francis Thompson, mining and metallurgical engineer, has been placed in charge of the El Paso branch of Mine and Smelter Supply Company and will direct that organization's activities in Arizona, New Mexico, West Texas, and Old Mexico. Mr. Thompson has been connected with Mine and Smelter since 1921, when he became manager of the El Paso machinery department. In 1930 he was made southwestern metallurgical engineer for the company's Marcy mill division. His work during the entire period has brought him this well-earned promotion.

"Thompson, a native of Boston, was graduated from Massachusetts Institute of Technology with the Class of 1914, receiving his B.S. degree in mining engineering and metallurgy. He left immediately for Crisman, Colo., where he served for two years as superintendent for the Logan Gold Mining Company. In 1917 he joined the Phelps Dodge staff at Tyrone, New Mexico, as metallurgist, but in 1919 was transferred to that company's Nacozari property, where he worked under H. Kenyon Burch in the experimental work for redesign of Phelps Dodge mills.

"For several years Mr. Thompson has given intensive study to the question of milling in general, and to the problems of the individual operator, collecting a wealth of operating data from mills all over the country, for the assistance of customers in the selection of proper machinery. He has written a number of reports on ball and rod mill grinding, flotation machines, flowsheets, and mill machinery, and has lectured on grinding and milling equipment. He is gifted with the ability to translate theories into practice."

These are about the leanest set of notes that have appeared in these columns for many months. When business was good the complaint was that there was not time to write to the Class Secretary. It has been reported in some quarters that business is not as good as it used to be. The flood of letters that should have come in if the old excuse were any good has not appeared. Now, if ever, we are all interested in learning what other members of the class are doing to combat the very serious condition that exists among engineers. Why not write a letter to your Secretary and tell him what you are doing? — HAROLD B. RICHMOND, *Secretary*, 30 Swan Road, Winchester, Mass. GEORGE K. PERLEY, *Assistant Secretary*, 21 Vista Way, Port Washington, Long Island, N. Y.

1915

It's the night before Xmas, but, contrary to the well-known poem, all is not well, for I have no letters from widely scattered classmates. Santa could best remember me with a load of letters. Unless you want this column, otherwise and formerly entertaining, to become a mere sophomoric list of names and addresses, about as interesting and amusing reading as the telephone book, you should write me. In addition to the duties of writing this, I at least have enough class spirit to seek out or rather glean a bit of news. On what I laughingly refer to as a selling trip, I met and talked with a number of our men.

In Detroit I saw C. Loring Hall, I, who is manager there for United Carr Fastener. Charlie has two children, the older one in high school. How these years roll by! But age has been kind to Charlie and he looks the same as of old. He would like to see or hear from some of his old Course I gang. Also in Detroit I saw Sam Berkowitz, II, now President of the Berkely Manufacturing Company, Utica, N. Y., manufacturers of pressed steel motor parts such as brake drums, wheel caps, and so on. Sam looks the part, settled, quiet, and prosperous. Sam has one daughter. — I telephoned Gabe Hilton, who, strangely, was in Boston while I was in Detroit so I suppose Arch Morrison and Gabe had a little reunion of their own.

In New York I talked to Jim Tobey, IX, as busy as ever at the Borden Company and writing new technical papers and books. St. Elmo Piza, IV, is as charming as ever. In addition to his daily duties as an architect, he is teaching several evenings at New York University. Ed Fonseca, VI, may be disturbed mentally about his business in Newark, but he fails to show it in his bright and congenial manner and cheerful appearance. Oh, yes, in Pittsburgh, Jim Tobey saw E. J. Casselman, X, a fellow at the Mellon Research Institute and very much a scientist. A lunch with Jerry Caldwell, VI, an engineer with Ford, Bacon and Davis, took me into the realms of big business. Jerry has some excellent contacts with large corporations and his observations on their reactions throws illumination on the feelings of some of the big executives. Jerry has two boys, still at the Santa Claus credulity age, but whose college education he is already carefully considering and planning.

Then I spent an evening at Bob Mitchell's, X, in Westfield, N. J. Bob received his Ph.D. in 1927 at the Institute, which, however, has not robbed him of any of his human traits. A lover of the out-of-doors, Bob has had some exciting and amusing experiences sailing, fishing, and tramping. In fact, he was planning to take me out on this bitter cold night for a touch of skiing and coasting but could find no steam-heated snow. Instead, we played ping pong, joined by Mrs. Mitchell. Their big league ability at this game removes it from the small boy's game we considered it years ago when you had to be careful the little celluloid ball did not collide with the gas flame. Bob walked me to the train the next frosty morning, thereby finishing a delightful and athletic visit. Bob has two daughters, who, in turn, have a charming mother.

Leslie Heath, V, is busy in Boston in his machine tool business providing for his class-record family of five boys and girls. — That's all the gossip for this month. Maybe next month you will finally succumb to my pleas. — AZEL W. MACK, *Secretary*, 379 Marlboro Street, Boston, Mass.

1916

In talking with some of our classmates recently, the inquiry was made why it was that your Secretary did not give more information about himself, so here goes.

A little over a year ago business in the golf ball industry became more than tough and I found that it would be impossible for me to continue the Arlington Rubber Company as a separate unit, specializing on golf balls alone. We had managed to keep ahead of the sheriff but as he was gaining on us each day I started looking around to see if some other rubber company would not be interested in starting a department for the manufacture of golf balls and take over what was left of the Arlington Rubber Company. After some negotiation, Stowe-Woodward, Inc., of Newton Upper Falls, Mass., took us over and all of the golf ball equipment was transferred to the Stowe-Woodward plant at Newton Upper Falls last June. I am now in charge of the manufacture and sales of the Golf Ball Department. Like every other industry, sporting goods have been subject to tremendous liquidation during the past year. Literally, golf balls were being given away. At the present time, all of this liquidation seems to have been completed and we look forward to at least a fairly stable market for the coming season. Our company specializes on private brand golf balls, although this season we are starting to build up our own brands in the consumer market. My family now consists of a wife and four children, two girls and two boys, the youngest being one year and if anything is left of the house after he goes away to school, I am going to be very much surprised. Being a golf ball manufacturer should mean that I could boast a low golf handicap. However, time has not permitted my becoming as proficient in the game as I should like to be.

I had a very pleasant call recently from Karl Engstrom. Karl is representing the Catty-Franz Euler Corporation, Boston distributors for the du Pont Cellophane Company. Karl is enjoying his work very much indeed for they seem to be one of the very few industries who still find themselves in an expanding market. Karl reported having lunch with Sandy Claussen recently and that he seemed as cheerful as usual. Karl also reported running across Dick Rowlett in Springfield. Dick has left his position in Hartford, and is now in the advertising game, located at 172 Chestnut St., Springfield, Mass.

When in New York last week, I called our noble president, Bill Farthing, on the telephone. Bill reported that he and his family were all well and that he would send me a good long letter for this month's contribution to The Technology Review. Suffice it to say, no such letter has as yet come to hand, but hope to give you all the dope in the next issue. —

1916 Continued

HENRY B. SHEPARD, *Secretary*, 269 Highland Street, West Newton, Mass. CHARLES W. LOOMIS, *Assistant Secretary*, Bemis Bro. Bag Company, Memphis, Tenn.

1917

Don Friend of 7 Mishawum Road, Woburn, hove in sight and I spent an interesting few minutes with him discussing recent developments in the field of plastics. Among other things, we discussed the fact that John Milton De Bell has joined the Hercules Powder staff as their Plastics Engineering expert or in some similar capacity. We understand that John's headquarters are to be Wilmington for the present.

Captain Hubert W. Collins, now in charge of the United States Army district engineer's office at Kansas City, and Miss Mary Eleanor Robinson of that city were married there on November 25.

Judge James W. Doon, still advancing in his political career, has become a member of the House of Representatives of New Hampshire. New Hampshire's House has long been known as one of the largest. Presumably it will now be known as one of the best.

Also spending much of his time in Concord is Philip Maher, operating a public accountant's service there and participating with Mrs. Maher in various golf tournaments. — RAYMOND STEVENS, *Secretary*, 30 Charles River Road, Cambridge, Mass.

1918

February already and only five months to our Fifteenth Reunion. Hardly seems possible, does it? But first let's take a look back to June 22–24, 1928. All Friday afternoon the boys kept arriving from Boston, from New York, from points beyond, from points between. Singly and by twos and threes they came; some with suitcases, some with bags, some with a better half, and some without. There were two Pierce Arrows and many Buicks, but only one lone example of that collegiate type of Henrietta which can look like a junk pile without going through the formality of an accident. It came the furthest distance, thereby overcoming any inferiority complex.

Bellis and Franklin made a game of seeing who could collect the most "I-remember-the-face-but-can't-just-recall the-name." Bellis won by the narrow margin of two "I-remember-but-can't-places." How few of us guessed that it would be his last reunion.

By supper time there was a goodly assemblage in the dining room and the fun began. Rightly or wrongly, Charlie Dow got the credit for starting it with his demonstration of a splash feed for the consommé. One of the girls screamed, "To the hills, to the hills, the dam's bust!" and joy was unconfined. It is reported that the fundamental, or was it the second harmonic, of the laughter was heard in three wards and 17 precincts of Providence, 43 miles away.

Meanwhile Don Goss, with inimitable cockney accent, was offering anything but the right explanation for the bedroom slippers he was wearing, the truth being that his afternoon game of golf had degenerated into water polo. However, Mal Eales came to the rescue, adroitly changing the conversation by his insistence that the crullers had a four-inch U. S. Std. thread instead of the regular three-and-one-half inch thread. His argument was learned, but unconvincing, the generally accepted theory being that the doughnut merely had a bad case of salt water cramps. And after such unmistakable signs of culture, Charlie Dow had the nerve to say that he would have enjoyed the meal but for the cheap talk.

A three-piece orchestra supplied by the hotel management for the dancing on both Friday and Saturday night left nothing to be desired, nor did the excellencies of the floor. During the intermission Eddie Rogal provided entertainment by causing pictures of the Institute, and even five-year-old images of the Boston crowd, to flicker across a suspended bed sheet. Howls of joy and sorrow rose from far and near at the movies of the Chem. lab and the Juice lab. of 10-250, and of Paul Howard oiling up his jaw action.

The orchestra tired at 11:30, but not the dancers. They migrated to the piazza from which to watch two stalwart men and true set off $50 worth of fireworks. Who threw the cigarette butt (or whatever it was) into the magazine is unimportant, but the way Gretchen, standing hard by, up anchored and luffed into the wind with all sails set was a sight to behold! Roman candles shot across the lawn like tracer bullets from a machine gun, aerial bombs exploded in the tennis court, the gallery ducked down behind the scanty rampart of the piazza rail. Then all was still. The two pyrotechnicians had covered the offending pieces with sand.

Shorty Carr's suggestion (in committee) of a midnight feed met with instant popularity, the great shame being that a late engagement prevented him from arriving until one a.m. Those who saw him parading the upper hall at that hour, lean of limb and comical of expression, with the fire axe over his shoulder, will have many a reminiscent laugh.

Saturday morning the dews of Heaven prevented the ball game Johnny Clarkson had tried to arrange. However, the golf tournament, under the expert management of Ralph Whitcomb, went forward merrily. After lunch all hands looked pleasant please for the group picture and then resumed their natural expressions.

There were numerous "business meetings" in room 44, the only one characterized by a tinge of gloom being that at which Shorty read a letter from Bob VanKirk telling of his accident and tendering his resignation as Class President.

The big events of the afternoon were the golf tournament finals in which Walt Robertson, Sax Fletcher, and Ralph Whitcomb won the prizes, the bridge party where Mrs. Goss and Mrs. Kelly carried off the honors, and the swim taken by the courageous ones.

What a glorious commotion the banquet on Saturday night proved to be. There were 58 of us blowing horns, ringing bells, whirling rattles and generally self-expressing ourselves through the medium of the lungs. The lower end of the table never did quiet down. Rogal brought in his Kleig lights and took some 300 feet of movie film. Shorty acted as toastmaster, leading the regular M. I. T. cheer, the "We are happy," the '18 locomotive, a cheer for Gretchen and her part in the reunion preparations, and various other vocal demonstrations.

Bob VanKirk had suggested in his resignation that the administration of Class affairs be undertaken by a committee. This we proceeded to elect, following the report Ev Rowe presented for the nominating committee. Carr, Clarkson, and Magoun are to represent Boston; Eales, Fletcher, and Foster the New York constituency.

The old days at Engineering A came back all over again when Earl Collins wrestled the piano away from the little lady of the orchestra. How he did rag the scale! That boy could jazz anything from a Chevrolet engine to a dial telephone.

Did the boys go to bed after the midnight lunch? They did not. Perhaps the most wonderful thing about the whole reunion was not the knitting up of severed friendships, nor the sheer joy of the good time, but the beginnings of new associations which make one regret not having known some of the boys better back in the college days. I, for one, shall long cherish a certain conversation with Nat Krass, and a later discussion with Jim Longley and Pete Harrall which lasted until the day broke and the shadows fled away. With feet propped on the white cot bed, we talked of life and death, of mystery and reality, of dreams and disappointment and achievement.

Sleepy-eyed and happy the little groups departed, some late Saturday night, others on Sunday morning, but all by Sunday afternoon. We were grateful for many things: the faultless accommodations of Weekapaug Inn, the wisdom of the Reunion Committee in selecting a location half-way between Boston and New York, and the consideration shown by the weather. Our Tenth Reunion was superlative, for if what we then felt could have been equally distributed among all the graduates of Technology, there would not have been one single unhappy alumnus on earth.

So start saving now. We've waited 15 years for this coming reunion and it is going to be worth waiting for. Start saving those pennies now. — F. ALEXANDER MAGOUN, *Secretary*, Room 4–134, M. I. T., Cambridge, Mass. GRETCHEN A. PALMER, *Assistant Secretary*, The Thomas School, The Wilson Road, Rowayton, Conn.

1920

December has proved to be a banner month in the career of your grubby old Secretary because two members of the Class actually took notice of his existence. One was good old Bunt Murphy, from whom I received a Christmas card containing a note to the effect that he is still alive and still in the U. S. A., much to his surprise. He says that he does itch

1920 Continued

to get back to foreign parts. Bunt has a son just past his second birthday, and Mr. and Mrs. Murphy and son, Richard, live at 236 Collins Street, Hartford, Conn.

My other correspondent was Bob Bradley who forwarded the welcome news of the arrival of another daughter, Sandra, born October 31. Bob resides at 39 Winn Street, Belmont. He is with the L-H-D Spring Corporation of Waltham. — I learn that Ed Bragg is now living in Scarsdale, N. Y. Lawrence Weymouth has moved to Bound Brook, N. J. Scott Carpenter is with the Waltham Watch Company and is living in Belmont.

Bud Cofren is running an engraving and printing business, the Suffolk Plate Printing Company in Kendall Square, Cambridge. Mr. and Mrs. Cofren have recently moved into their new home in Wellesley Farms, a very charming and attractive stone house, judging by the sketch of it on their handsome Christmas card.

I had a very pleasant visit with Ted Hobson at Ted's office in Lowell recently. Ted is in the heating supply business and doing a mighty good job of it, judging by appearances. He said he had seen Joe Hennessy not too long ago and that Joe was back around Boston in the contracting business. We had a good time reminiscing about the gang and past reunions and agreed that we ought to have at least a small get-together this coming spring. I hope to hear from some of the rest of you about this. — HAROLD BUGBEE, *Secretary*, 7 Dartmouth Street, Winchester, Mass.

1922

With a sincere desire to function at least once in the second six months of 1932, we are rushing under the wire at the 11th hour a few short notes for this February issue of The Review. Don't feel that your Secretary has been giving you a poor example. You well know individually how often you have contributed any items of mutual interest to this column, and realize that there has been a dearth of interesting notes for me to pass on to other members of the Class. Possibly with a New Year coming you will be encouraged to drop a few lines to be included in the class notes during the spring. We all hope so and shall anticipate word from you as to your whereabouts and what you have been doing.

Here are a few jottings received from the Alumni Office and through news clippings: C. E. Locke writes that Al Rairden is apparently breaking into the job of coroner. This seems to be indicated by an article by him which recently came to our attention. It bore the title "Post Mortem Shows How Wire Rope Dies." — Another note from C. E. Locke states that Dr. M. Ewart Hurst of the Ontario Department of Mines spent the summer season doing field and underground examination in the Porcupine gold area.

Sid Biddell has found the secret of mass production at low-unit cost in the book publishing business. He has startled his fellow publishers by proving that enough more people will buy books at 50¢ each than at $2.00 to make their sale profitable. Biddell says that it is a proven fact. After marketing 2,000,000 mystery novels through chain stores in two years, he now has a contract to market a new book every week through 70,000 stores and shops where magazines are sold, at 50¢ per book. He is quoted as saying: "We are doing with books what Henry Ford did with autos, and we are going to put it across with nation-wide newspaper advertising."

A note from the Boston *Transcript* tells of the marriage of Miss Virginia English to Roscoe Sherbrook. Roscoe and his bride are residing in Brookline. — From Wilmington we have received word of the announcement of the engagement of Dorothy Curtis to Willard Purington. — Dexter Shaw married Edna Elizabeth Olney in Lowell in October. Dexter is engaged in the practice of patent law with Howson and Howson and is a member of the Supreme Court of Pennsylvania.

Luke Walton and Gertrude Serrill McCord of Bloomfield were married in November. They spent their honeymoon in Bermuda and are now living at 39 Oakland Avenue, Bloomfield, N. J. Luke is Executive Vice-President of Arnold, Constable and Company and we understand is extremely successful in the department store field. — Your Secretary sends his warm regards to the members of the Class and joins with Heinie in wishing you all good fortune in the coming year. — RAYMOND C. RUNDLETT, *Secretary*, The Curtis Publishing Company, Lincoln Building, 42nd Street, New York, N. Y.

1923

On November 15 the New York Club of the Class of 1923 held its first meeting of the year. I should have reported on this in last month's notes, but as I prepared them while on a trip at Birmingham, Ala., I did not then have Pete's account of the affair. I'm fortunately back home just in time for Christmas and also to just sneak this month's notes in under The Review's deadline.

The following 15 were present: James V. O'Connor and Lem Tremaine, II; Charlie Roche, V; Rod Goetchius, Dick Kleinberger, Charlie Mapes, Paul Ryan and Ed Thimme, VI; Bob Henderson, Philip Smith, and Bob Shaw, VI-A; Walter Dietz, VIII; F. P. Squibb, X; Dave Kaufman, X-B; and Channing Clapp, XIV. The principal entertainment of the evening was furnished by a series of contests involving spelling, pronunciation, and intelligence tests, in which, says Pete, "We were all dumb together."

The meeting was principally noteworthy, however, because there the first discussion of the forthcoming Tenth Reunion took place. As a result, Bob Shaw has appointed a committee to formulate some plans for the affair. There are apparently a lot of factors to consider, especially of keeping costs as well within bounds as possible. As a meeting place, a point somewhere about midway between New York and Boston has been suggested. The members of the class in the Boston area have been inarticulate so far as expressing themselves one way or another about the reunion, so I have written Bob to tentatively go ahead on any basis acceptable to the New York committee. In the meantime some of us around Boston will get busy, so that by the time these notes appear some movement will probably be on foot. We're going to need help and this is a request that those who want to and can help get in touch with either Bob Shaw at the Museum of Science and Industry, New York, or with your Secretary here in Boston. My phones are Hubbard 1630 and Braintree 0141. Those outside the Boston or New York areas should write to say what they would like to have in the way of a reunion program, place, time, or other suggestions.

Because no program has been formulated as yet it isn't possible to say much more about it now. Because of the time it takes notes in The Review to get into print, we shall probably have to announce reunion plans by correspondence from time to time, so be looking for further announcements.

Before leaving the subject, it should be recorded that the officers of the New York Club for the coming year are to be Squibb, President, Walt Marder, Jr., Vice-President, Pennypacker, Secretary, and Goetchius, Treasurer.

The December notes mentioned the marriage of Bobby Burns, I. Bobby writes that his Scotch instincts prompted him to delay sending me an announcement until he could combine it with a Christmas card and a letter as a means of thwarting the increased postal rates. The bride's name was Lillian Isabel Campbell and the wedding took place at St. Paul's Church, Philadelphia, October 1, 1932. Bob states his connection more clearly than we could previously report it, as Calibron Products, Inc., a new corporation of which Theodore M. Edison, VII, is President.

N. H. Frank, XIV, of the Physics Department at the Institute, says a recent address change is of no special significance, but adds, "However, as you may know, I did spend a year at Munich, Germany, and was married there in December, 1929. Since returning here I have the job of seeing our good freshmen through in 8.01, and that *is* a task. Ben Drisko, XIV, is around town these days and very much interested in things electronic, spending considerable time at the short wave and television outfit."

I am indebted to Bob Hendrie for the following items about Course I men: Si Rice has entered the life insurance business and is now connected with the Paul Clark Agency of the John Hancock Mutual Life Insurance Company. Al Stewart, construction engineer for the U. S. Treasury Department, has been resident engineer on several government jobs in this section and is now working on the Brockton Post Office.

Address changes this month are few but the two following are noted: Francis D. McGinnis, II, from St. Louis to Cambridge, and Major Roland P. Shugg, IX-B, from Fort Leavenworth to the

1923 Continued

R. O. T. C. unit at Princeton University. — HORATIO L. BOND, *Secretary*, 195 Elm Street, Braintree, Mass. JAMES A. PENNYPACKER, *Assistant Secretary*, Room 661, Eleven Broadway, New York, N. Y.

1926

The First Lady of the Class, Mrs. David Shepard, has presented the Class with a second First Lady — or, if you please, a First Second Lady. Her name is Clara Berney Shepard, and Dave's letter of announcement exuded his enthusiasm and pleasure over the event. — Dave isn't the only proud father. Al Bassett has announced the birth of Barbara Allen and Pop Constantine of George. In behalf of the Class, the Secretary extends best wishes to these additions to its ranks.

Ariel F. Horle, who has been continually in Mexico since graduation, with the American Smelting and Refining Company, was delegated by his Company to take charge of exploration work on a gold property in California. He reported that this latter job is now finished and he has been returned to Mexico, where he is located in Chihuahua with the job of doing geological work with the Santa Eulalia Mines. — Al Warner writes that he is still in the electric brake business in Beloit, Wis. He reports seeing quite a bit of Lieutenant E. K. Warburton, who is at the present time located at Selfridge Field, Mt. Clemens, Mich. — F. P. Ward has recently been appointed manager of the Hartford office of Lewis and Magee, Inc., advertising agency. — Francis W. Romanoff was married last April to Miss Helen Wolberry of Philadelphia, Pa. Romanoff is metallurgist in charge of plant operations of the Apollo Metal Works in LaSalle, Ill.

Red Elmendorf, who is with the Cleveland Wire Works in Cleveland, Ohio, and who was in Boston for the Christmas holidays, reports seeing Al French occasionally. Red has had an important part in the planning and erecting of the world's largest single plant for the production of lamp wire and gas. His work has been concerned primarily with the reduction of tungsten metal. He also reports seeing Bill Sessions occasionally, who is plying a successful business as patent lawyer, a vocation he took up after attending Western Reserve. — Stanley P. Sawyer reports having been married for three years. He is living in Woburn, Mass., at 44 Poole Street. — J. RHYNE KILLIAN, JR., *General Secretary*, Room 11-203, M. I. T., Cambridge, Mass.

1928

COURSE I

Our annual news from Jones comes in the form of a Christmas card, from Scio, Ohio. To the name of this town Jonesie adds in parentheses: "750 people, 12 miles to a movie!" Such maps of Ohio as I have available do not indicate this metropolis, so it is impossible to say whether or not Jones is still engaged in building pottery kilns.

The following is the latest about Bill Hammond, address Y. M. C. A., New Brunswick, N. J.: "Made a trip to Montreal this summer and went to Washington, D. C., a couple of times to look around. A few of us here are doing a little riding but are just as rotten as at Ft. Humphreys, and are still meeting our horses half way. The only excitement on the 'Pennsy' is an occasional electric train testing out the line between Manhattan Transfer and New Brunswick, where the wires were recently energized."

The December issue of *Civil Engineering* announces Rice's election and Jameson's reinstatement to the A. S. C. E. Jake resigned from the Society a year ago. We don't know if that meant that he was leaving engineering for another line, but his reinstatement must indicate a return to, or continuance in, engineering work. — Morrill is in New York working on a construction job for a contractor affiliated with Stone and Webster. — Weinberg is now working for the operating department of the new Independent Subway System here. — Met Louis Vargas down town one day. He is married and is the father of a baby girl. He told me that Pete Moyano was working for a Mexican power company but was unable to give any exact details. — GEORGE P. PALO, *Secretary*, 426 East 238th Street, New York, N. Y.

1930

COURSE VI-A

I am very happy to announce the birth of what I consider the course baby for 1930. The boy, Granger Dana Schrader, Jr., was born November 14, 1932, and I'm ready to put him against all contenders for the title of course baby. Of course, I realize that J. R. Miller has a family, but my contention is that since he started in the course with that advantage he should be politely disqualified.

After a diligent search I have finally located Bill Griffith. Steven Prendergast tells me that Bill is teaching in Far Hills, N. J. I'll bet the students always know their stuff in Bill's class. I know that if I was one of them I wouldn't dare to be dumb.

A very welcome letter was received from Frank Burley recently. Frank is now working as a radio engineer for Philco and is living in Philadelphia. — I understand that E. D. Goodale is working on radiation development with R. C. A. Since Harrison, N. J., is not far from here he may be living next door for all I know. We shall have to get together and talk it over — over the coffee and cigars. Have you got any cigars, Dud? — EARL E. FERGUSON, *Secretary*, 60 Eaton Place, East Orange, N. J.

1931

Greetings! A letter from Art Lutz corrects the impression that I had led abroad (imagine) that he was working for the National Theatre Supply Co. Art is working for his father's lumber company — and although he is surrounded by wood all day, he is not the least bored. In fact, they manage to keep him pretty busy all the time. Also let it be known that Art is not in the "sticks," because he talks of nightmares in his letter and only people living around New York are interested in such things. (Art lives in Brooklyn.)

Speaking of politicians, I am told that Portsmouth's political pride, Wy Boynton, has achieved his ambition and has been elected to the State of New Hampshire Legislature. Congratulations Wyman! The rest of the boys in New Hampshire are going straight — to Wyman for political jobs. They figure that the work that they had at the Institute in graphs should stand them in good stead. To get back to Art Lutz (and many a man has walked the Brooklyn Bridge), he tells me that he saw Fred Brooks of late and that Fred had been working his head off, which is something even you will admit. But even Fred refused to lose his head over a job and he has come back to Boston, where he is working for a local merchandising firm. Fred expects to be back in New York before long, however. He says that he is interested in getting located on the "Street" and asked me if I thought that it was a good idea. I said "sewer" if you've "gutter" liking for that sort of thing.

Ran into John Spalding the other day. He is working in Rumford, Maine. Just what he is doing in Rumford I do not know, but he is working and that is the main thing.

Randy Binner dropped into the office the other day from New York, which is, incidentally, quite a drop. Randy has been time-keeping on the new Radio City project. He used the time he has kept to take a trip to Cambridge. I asked him if prosperity was just around the corner in New York and he said that business was so dead that he thought that prosperity must be just around the coroner.

Lou Morse is working for a patent attorney's office in Washington. If any of you have any patent problems, I am sure that Lou will be able to help you, even if he only gives you a pat'en the back.

Saw Ralph Davis and find that he has been around Boston for some time. He is in the insurance business, but he can't be selling life insurance or I would have seen him before this. If he is selling it, he is the only agent that I haven't seen. Ralph's old *The Tech* running mate sent a Christmas card to the department of which I am a humble part. Thanks, Ed!

Dave Buchanan has come to light at the Brooklyn Edison Company, where he is doing electrical appliance work in the inspection division. Dick Baltzer — that old cross-countrier — has run himself into another job, which is something. Dick is well pleased — as he well should be — because it is a step forward. Jerry Cook is making a special study of the housing situation — getting the hows and whyfores. B. T. Ottaway is with the State Department of Public Works and is working on the Wellesley division of the Boston and Worcester Turnpike. I'd hate to be held as a suspicious person, but the Wellesley locality has a familiar note to it. In the old days the note used to be "do." — JOHN M. MACBRAYNE, JR., *General Secretary*, Room 1-181, M. I. T., Cambridge, Mass.

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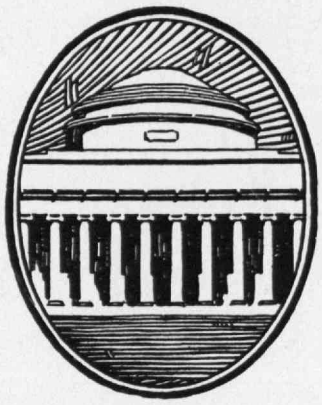

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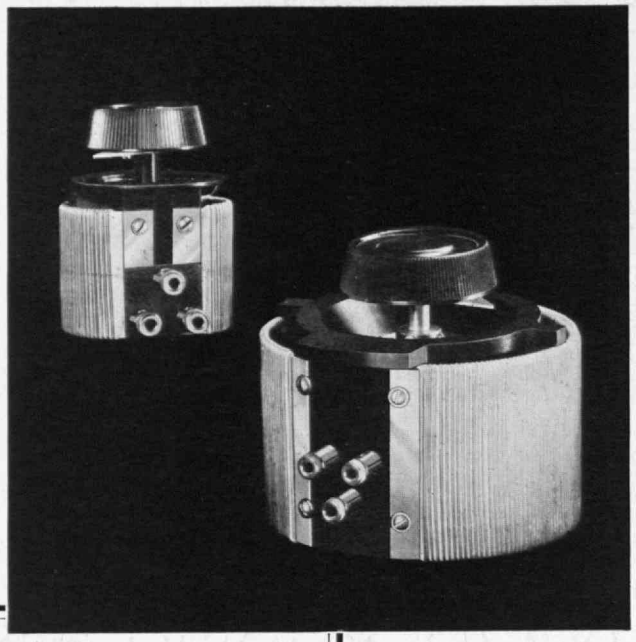

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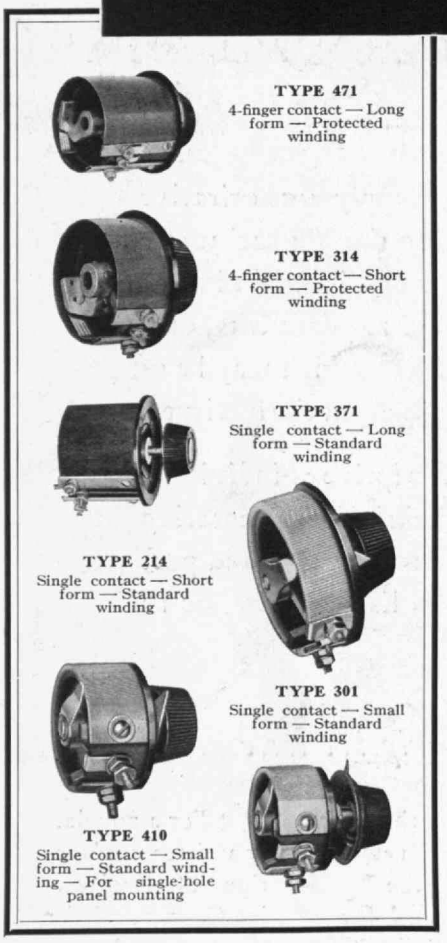

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